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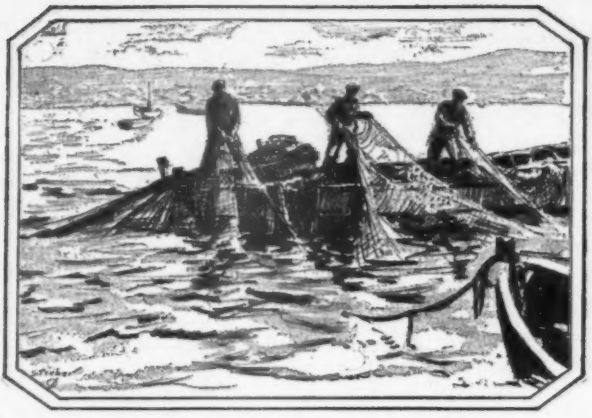

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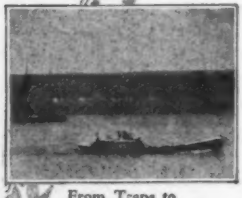

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SOME DISEASES IN THE JEWISH RACE

Lecture II of the William Sydney Thayer and Susan Read Thayer Lectures in Clinical Medicine (1928)

SIR HUMPHRY ROLLESTON, Bart., K.C.B., M.D.
Regius Professor of Physic in the University of Cambridge

The study of constitution in relation to disease, the influence of heredity on the incidence of disease, the effects of environment in the same direction, and the interplay and the question of the relative importance of these factors, which it is attractive but so difficult to decide, may perhaps justify a brief consideration of the diseases specially common among the Jews. This race, remarkable for the contrasts it presents of high culture and intellectual ability, wealth and luxury, on the one hand, with, on the other hand, an incidence of mental defectives said to be higher than in any other civilized race (Fishberg[1]), poverty and hardship, was estimated in 1910 at twelve millions, or only a small fraction of one per cent of the white population of the world. Widely spread over the globe, and though showing some tendency to resemble the nations among whom they live, the Jews have preserved their racial type in a very remarkable degree. It has been suggested that the long persecutions that the Hebrew race has suffered may have led to the survival of the fittest, but, if so, the obvious presence of many unfit shows that the process is not finished. The race would thus provide an interesting study in connection with the problem of the influence of environment versus heredity on the incidence of disease. The present crisis in Zionism may produce results difficult to forecast. There are now about $3\frac{1}{2}$ millions of Jews in the United States of America, about $2\frac{1}{2}$ millions having entered the country between 1881 and 1924, when this mass immigration was abruptly checked by the national quota system of the "Johnson Act." The Jews multiply rapidly from their comparatively low infantile mortality and longevity, not, it is said, from a high birth rate; for,

[1] Fishberg, M.: *Journ. Hered.*, Washington, 1917, viii, 543.

with the disappearance of the religious influence (Namier),[2] birth control is likely to become stricter among them even than in France. What effect in the direction of an increased number of mixed marriages the changed conditions of Zionism may induce, and so modify the constitution and morbid tendencies, remains to be seen in the future.

Some diseases are chiefly seen in, though not absolutely confined to, Jews, and in at least two of these it is noteworthy that when the diseases (cerebro-macular degeneration and thrombo-angiitis obliterans) occur in gentiles they appear later in life and are less severe in their manifestations than in Jews, thus suggesting that the inborn tendency is more powerful in the cases with a Hebrew heritage.

AMAUROTIC FAMILIAL IDIOCY

The first case of this racial and familial disease was recorded in 1881 by Waren Tay (1843–1927) from an ophthalmological point of view as "Symmetrical Changes in the Region of the Yellow Spot in each Eye of an Infant;" subsequently the disease was independently described from a neurological standpoint as "Arrested Cerebral Development" by B. Sachs in 1887. In 1892 Kingdon correlated these two separately described conditions into what is often eponymously called Tay-Sachs' disease. The name amaurotic family idiocy was suggested by Sachs in 1896. In 1894 Carter pointed out its racial incidence, and among Heveroch's 86 collected cases 61 were Hebrews; the parents are often, if not usually, poor Polish immigrants. Dr. Horsley Gantt informs me that only five cases (one in a Russian, four in Jews) have been recorded in Russia. Up to 1917 there were 100 cases on record (Cohen); 10 of these were in gentiles (among Heveroch's cases there were 7; Cockayne and Attlee; Tarr; Cohen's cases were added). Since then de Nicolo and Chalatov have reported cases in gentiles. It has been said to be a Mendelian recessive through inheritance of recessive unit characters which may be present in other surviving members of the family.

There is not any evidence of inflammation of the central nervous system, such as a vascular lesion, of the influence of a bacterial toxin, of malformation, arrest of development, or of a primary endocrine defect. It may be difficult to exclude the delayed action of an endog-

[2] Namier, L. B.: *New Statesman*, 1927, xxx, 103 (Nov. 5, 1927).

enous toxin of maternal origin during foetal life. According to Poynton, Parsons, and Holmes it is a primary disease of the whole central nervous system affecting the nerve cells, including those of the dorsal root ganglia and the retina, more than of the nerve fibres, due to some inherent bio-chemical property of the cell protoplasm; Mott came to the same conclusion. It is characterized by a selective degeneration limited to the ectodermal tissues with a systemic degeneration shown by demyelination of the nerve fibres. Leiner and Goodhart describe two infantile cases without myelin-sheath degeneration, thus resembling the juvenile cases which occur in gentiles, and point out that among the infantile cases there are a number of groups showing minor differences in the histological changes, but all linked together by the ectodermal selectivity and the different degrees of Schaffer's type of cell degeneration. Parsons pointed out that the cellular change is not a simple atrophy, but an excessive growth of the protoplasm which later degenerates, and that this sequence of events does not lend any support to the otherwise attractive explanation that there is an inborn want of vitality—as expressed by Gowers' word "abiotrophy" from abiosis, abiotic atrophy—of the central nervous system. Collins, however, regards it as an abiotrophy of the ganglion cells of the retina, just as he considers symmetrical familial pigmentary degeneration, which has not any racial proclivity, as abiotrophy of the cones at the macula, and retinitis pigmentosa as abiotrophy of the retinal rods and cones.

Although potentially congenital in origin, the infants appear normal at birth, and some (3 to 6) months pass before the onset of symptoms. Optic atrophy leading to complete blindness, the characteristic macular changes, progressive changes in the central nervous system resulting in dementia and muscular weakness, and death within two years, make up the clinical picture.

Infantile and juvenile forms. By its racial incidence amaurotic family idiocy is strikingly distinguished from various forms of progressive cerebral and macular degeneration, which somewhat resemble it, especially the so-called juvenile form of amaurotic family idiocy (Vogt), and familial cerebral degeneration with macular changes (F. E. Batten). There are also cases both of the infantile form (Weber) and of the juvenile form without macular changes, though otherwise

similar, and others with only retinal changes and subsequent pigmentation—primary macular pigmentary degeneration (T. Collins), as in R. D. Batten's cases in which symptoms came on in two brothers about the fourteenth year. These forms in gentiles are hereditary and familial, but usually occur less early in life than amaurotic family idiocy, about the sixth year or later, and are much milder, so that the neurological symptoms are insignificant or even absent, and the patients may survive; thus, Neave recorded familial macular atrophy in a woman aged 40 years and her two brothers. There are, thus, in the juvenile form groups of cases showing slightly different histological changes and forming transitions. In 1925 Greenfield and Gordon Holmes described this histological picture as "a primary change in the ganglion cells combined with an independent degeneration of the outer neuronic elements of the retina, which in some cases extends to the inner nuclear and inner reticular layer."

The primary macular pigmentary degeneration, often with, but sometimes without, cerebral degeneration, has some relations with the group of cases of retinitis pigmentosa which occur early in life, run a rapid course and are often associated with mental defects, such as idiocy and deaf-mutism. There is thus a connecting link with other cases of retinitis pigmentosa beginning less early in life, running a slower course, and rarely accompanied by mental defect; this latter condition is also hereditary, though sometimes discontinuous, so that Nettleship regarded the disease as then recessive in a Mendelian sense, though dominant in cases of continuous transmission. Retinitis pigmentosa has been regarded as common in Jews and due to the frequency of consanguineous marriages (vide Fishberg); but little stress can be laid on this, and there is not any mention of a Jewish proclivity to it in Bell's monograph. In connection with the inter-relations of the foregoing eye changes attention may be called to a case, recorded by Mary Buchanan, of a Jewess with retinitis pigmentosa whose infant had amaurotic family idiocy, thus suggesting "anticipation," or a more powerful and effective attack by the morbid process. In a very interesting and copiously documented paper Weber has collected material about the combination of retinitis pigmentosa with (1) hypopituitarism, described as the Laurence-Moon-Biedl syndrome by Solis-Cohen and Weiss who record four cases in an Italian family with

Fröhlich's syndrome and retinitis pigmentosa; Weber reported a case in a Jew aged thirty-five years; (2) with incomplete Recklinghausen's disease, thus showing a widespread abnormality in the nervous system.

Between the infantile type of amaurotic family idiocy, which has a predominating racial incidence, and these aberrant forms of retinitis pigmentosa there are, through the juvenile groups of macular and cerebral degeneration, a number of transitional forms of disease which make up a chain, the links of which are less early in onset, less serious, and not prominently racial in incidence. It may be pointed out that this suggests a common factor which, though not confined to the Jewish stock, is much more powerful in them than in gentiles.

The same relation existing between the infantile and juvenile types of amaurotic family idiocy is discernible between Niemann's disease (lipoid-celled spleno-hepatomegaly) and Gaucher's splenomegaly.

THROMBO-ANGIITIS OBLITERANS

Synonyms: Buerger's disease: non-syphilitic arteritis obliterans of Hebrews (Weber); die Hebraische Krankheit; glycophilia (Willy Meyer)

The name thrombo-angiitis obliterans was coined in 1908 by Leo Buerger of the Mount Sinai Hospital, New York; endarteritis obliterans had of course been described previously, but not as a special racial disease. In England Parkes Weber described early in 1908 "arteritis obliterans of the lower extremity with intermittent claudication (angina cruris)" and has often discussed the subject since. In 1924 Buerger collected 500 cases, all but 4 in Jews, and only 3 in females. Jablons found 20 gentiles among his 200 cases, and quotes Idelsohn's 40 per cent of gentiles among 226 cases: among 300 cases at the Mayo clinic just over 50 per cent were Hebrews (Allen). It is certainly becoming more widely recognized and, it is thought, actually more frequent.

The condition is characterized by its incidence almost only in men and earlier in life than senile gangrene, by absence of evidence of syphilis, by occurrence of intermittent claudication, redness or cyanosis of the feet when in a dependent position, thus resembling erythromelalgia, patches of wandering superficial thrombo-phlebitis in a certain number of cases (35 per cent Allen and Brown), and gangrene

of the extremities (137 out of Silbert's 258 cases). A leucocytosis has been recorded in the acute phase (Thomas), but Jablons contested this. It specially attacks Jews in Russia, Poland, and also in Galicia, Rumania, and European Turkey, and immigrants in America, England and elsewhere. Rich are affected as well as poor.

The process is an inflammatory thrombosis involving not only the larger arteries and veins, but their finest branches and even the capillaries (Constam). It shows (1) an acute inflammatory lesion with occlusive thrombosis and the formation of miliary foci resembling tubercles or minute abscesses with giant-cells (Buerger (1917)); these giant cells, which Buerger (1920) regarded as abortive attempts on the part of angioblasts to organize an infective focus, were not found in a British case published by Marnoch and MacRae; and in their British cases Telford and Stopford described infiltrating cells as lymphocytes and not polymorphonuclears; (2) later organization of the clot with disappearance of the inflammatory and giant-celled foci, and canalization; (3) the formation of fibrous tissue in the adventitia which binds together the artery, vein, and nerves; microscopically, the nutrient arteries of the nerves may be involved (Marnoch and MacRae). This might account for vasomotor phenomena which may make the diagnosis from Raynaud's disease difficult (Allen and Brown). Bacteriological examination has so far failed to establish a microbic cause, though Rabinowitz described a Gram-negative beaded bacillus which produced similar lesions in rabbits.

Buerger and Weber, with much experience of poor Russian and Polish Jews in the East End of London, both regarded it as a disease of Jews; this opinion has been criticized on the ground that Buerger's statistics were mainly based on observations at a Jewish Hospital. Buerger, however, quotes 120 cases collected in Japan between 1900 and 1921 (Koyano), and in a letter to Boyer and Thibault states that he has seen about 20 cases in American Christians. It is said to be relatively common among the yellow races, and in China (Whyte; Meleney and Miller). The questions of its peculiar racial incidence and whether or not it really differs from obliterative arteritis in gentiles have been much discussed. Gilbert and Coury regarded it as sharply defined from other forms of chronic obliterative arteritis, not only clinically but pathologically; and Sicard, who shared this view,

suggested that its high incidence in males was due to over-stimulation—quantitatively or qualitatively—of the adrenal medulla by the testicular hormone. It may be mentioned that von Oppel (1921), believing that excessive production of adrenalin causes hyperglycaemia arterial spasm (suprarenal arteriosis), and nutritional damage of the vessel wall leading to thrombosis and spontaneous gangrene (gangraena arteritis suprarenalis), has performed suprarenalectomy, with his Russian colleagues, in 115 cases; Leriche in France has also carried it out in 6 cases, and von Oppel has more recently advocated it again; but according to Sénèque the operation is passing out of favour.

Constam's 4 cases, in which the hands were markedly affected, were all in gentiles; he states that 80 per cent of 94 cases of thrombo-angiitis at the Mayo Clinic had been wrongly diagnosed. Telford and Stopford reported 6 cases (2 women aged 48 and 52, and 4 in men 37, 40, 44, 52) in British subjects, and the condition has been recorded in other British born men (Girdwood (male 35)) and Marnoch and MacRae (male 59)). Professor Stopford tells me that he has now seen 32 cases, none in Jews, in the Manchester district which has a large Jewish population. Telford and Stopford regarded the incidence in Jews as "a topographical accident," and Guillaume and also Lian, Puech and Viau have contested the view that it is a disease peculiar to Jews, though it is admitted that they are particularly prone to suffer from it and earlier in life than gentiles. Lian and his colleagues recorded 52 cases, all but 2 in males, and ascribed it to a metabolic disturbance occurring about the age of 50 in gentiles, but earlier in Hebrews, and argue that the characteristics of the disease as described in Jews may all occur in gentiles. Guillaume, writing on "Soi-disant maladie de Buerger," definitely opposes the argument that because it occurs earlier in life in Jews the condition is special to the Jews. He considers that the arterial lesions in gentiles differ according to the age of the patients, and regards the cases in Jews as merely a juvenile form of the endarteritis ordinarily met with in other races. Moulonguet and Pavie strongly support Buerger's contention that the thrombo-angiitis of Hebrews is the result of a special histological lesion and differs from syphilitic and juvenile arteriosclerosis, which of course may also cause gangrene and so clinically resemble it. The spontaneous gangrene ascribed by von Oppel to excessive secretion of

adrenalin causing arterial spasm and degeneration ("artériose surrénale") may well be yet another form of juvenile gangrene, which may be confused with that occurring in Jews; it does not appear that von Oppel's 115 cases were characterized by Jewish incidence. Netter, who is in favour of the racial character of the disease, supports Gilbert and Coury's suggestion that the early incidence of the affection in immigrant Jews is connected with their proneness when infants to have typhus in Russia, Galicia, or Poland, and perhaps the modified form described by Brill as sporadic in New York, the damage thus done to the vessels perhaps accounting for the earlier incidence of vascular thrombosis. But this does not explain the great predominance of male sufferers.

In all the cases of thrombo-angiitis obliterans that he examined Willy Meyer found hyperglycaemia after the ingestion of 100 gms. of glycose given after a brief fast, the high blood sugar being ascribed to the action of swallowed nicotine in the duodenum on the pancreas (1920); he therefore proposes to call the condition glycophilia, the similarity of the name to haemophilia being intended to point to its sex-limitation and other obscure features. The hyperglycaemia might be thought to be an etiological factor and, in association with the liability of Jews to diabetes, to strengthen the opinion that thrombo-angiitis is specially a disease of Hebrews. But Morrison and Ohler's results of blood sugar tests on Jews and gentiles did not support the view that race alone is a factor in the incidence of high blood sugar curves.

It seems to be generally agreed that its victims have been heavy smokers, especially of cigarettes; it is possible that there is an underlying want of vital resistance in the vessels (Gowers' abiotrophy) and that tobacco is thus able to act with much more effect in causing vascular spasm and in favouring the attack of the unknown agent causing the acute arteritis; but it is very improbable that tobacco is the sole etiological factor; that there may be such an innate defect is suggested by the occurrence of vascular hypoplasia in some cases (Weber 1916). Among Buerger's 500 cases smoking was denied in one per cent; Parkes Weber who wrote a full account of it in 1916 had then never seen a case in a man who was not or had not been a free cigarette smoker, or in a Jewish woman or child. But Frauenthal

recorded a case in a boy aged three years. Lian, Puech and Viau found that out of 25 patients 23 smoked more than ten cigarettes daily, and considered that, as no other cardio-vascular disease showed such a high percentage of smokers, smoking is an important factor in the causation of intermittent claudication. It is interesting to recall tobacco angina in connection with the cramp in the muscles of the legs (intermittent claudication) in thrombo-angiitis obliterans. From observation of 350 cases Silbert is convinced of the importance of smoking as an etiological factor; he has never seen it in a non-smoker, has seen it delay improvement that otherwise should have followed treatment, bring on a relapse after treatment has relieved the symptoms, and has observed improvement when the habit was given up.

In some cases of thrombo-angiitis obliterans there has been erythraemia (Weber (1921); W. Meyer), and it has been suggested that this may be due to thrombosis of vessels in the spleen; it is noteworthy that in at least four of Weber's collected cases of erythraemia the splenic vein was thrombosed. On the other hand the hypoplasia of the arteries found in some cases of thrombo-angiitis might favour thrombosis in the presence of the stasis accompanying erythraemia.

The question as to the occurrence of thrombo-angiitis obliterans in other internal organs and especially in the heart giving rise to the syndrome of coronary thrombosis and infarction, first established in 1910 by Obratzow and Strachesko, is of interest. J. Heitz, who quotes cases of thrombo-angiitis obliterans combined with angina pectoris by Weber and Cawadias, reports 12 cases of his own (1 female), all about fifty years of age, in which this syndrome occurred. There is not any statement as to the nationality of the patients, and the cases were of different kinds; three or possibly 4 of his cases were syphilitic, and 2 were diabetics. In 7 of his cases the anginoid symptoms preceded the intermittent claudication. Dr. John Parkinson tells me that among a hundred cases of cardiac infarction, analyzed by him and Dr. Bedford, there was not any case of thrombo-angiitis obliterans; they believe that cardiac infarction is more frequent in Jews than in other races: in their series, 43 were Jews, but, as the London Hospital stands near a large Jewish community, they decided not to publish these figures as conclusive. Among their 100 clinical patients with cardiac infarction 93 were males, and 78 were fifty years of age or over.

Among Wearn's earlier series of 19 cases 9 were in women and 18 over 40 years of age. Jablons merely states that cardiac embolism or coronary thrombosis is a common terminal event in thrombo-angiitis obliterans, but does not give any figures. There does not appear to be any evidence that thrombo-phlebitis occurs in the retinal vessels.

To sum up: It would appear that, though the syndrome is not confined to Jews, there is a racial liability to a special arterial lesion which is responsible for the incidence of this clinical manifestation both more frequently and earlier in life, and on a provocation—smoking—which is not prone to have this effect to anything like the same extent in gentiles.

GAUCHER'S AND NIEMANN'S DISEASES

Gaucher's disease. In 1882 C. P. E. Gaucher in his Paris thesis first described the condition, which now commonly goes by his name, under the title of "épithéliome primitive de la rate." In 1926 L. Pick critically accepted 39 cases, and in 1927 Klercker brought the number up to 60. The Jewish race figures largely, but far from exclusively, among the patients, possibly 40 per cent showing this racial incidence. Mandlebaum, Pick, Bloom, and others are emphatic that the Gaucher substance which distends the reticulo-endothelial cells into the characteristic Gaucher cells is not a lipoid; the condition would therefore differ chemically from infiltration of the reticulo-endothelial cells with lipoids in the lipoid histiocytosis of Niemann's disease, diabetic lipaemia, and animals fed on excess of fats or cholesterol. But the histological appearances are so similar that it is only recently that a distinction has been drawn between the Gaucher cells and the "pseudo-Gaucher cells," as Aschoff has called them, in Niemann's disease and the other conditions in the second category. It is extremely interesting that Graham and Blacklock have by heating frozen sections up to 100°C., and so probably causing hydrolysis, found that the Gaucher cells take up the fat stain from Sudan III or Nile blue.

Niemann's disease. (Synonyms: Lipoid-celled spleno-hepatomegaly; lipoid histiocytosis.) This condition was recently separated from Gaucher's splenomegaly on the grounds that it differs in the

chemical constitution of the material—a lipoid—occupying the reticulo-endothelial cells, and clinically by its rapidly fatal course. It was described as an unknown disease by Niemann in 1914. Pick gave a fuller account of it in 1926, and Bloom called it Pick's disease. Since Bloom's paper analyzing 7 cases, others have been reported (Schiff; Hamburger), and probably, as Bloom argued with regard to the 2 Jewish infants recorded as Gaucher's disease by Knox, Wahl, and Schmeisser, other reported instances of Gaucher's splenomegaly may really have been of this nature.

Out of 7 cases collected by Bloom 5 were in Jews, so that as far as these small figures go it is more decidedly racial than Gaucher's splenomegaly; in this connection its association with amaurotic family idiocy is interesting (Hamburger); it has also been combined in two cases with mongolism (Niemann; Bloom). It is familial and proves fatal under two years of age, thus agreeing in the first feature and differing in the second from Gaucher's splenomegaly which, though it commonly begins in childhood, runs a very chronic course. In addition to the qualitative distinction between the chemical constitution of the Gaucher material (kerasin) and the lipoid histiocytosis in Niemann's disease there is a quantitative difference between them; the Gaucher cells are much more restricted in their distribution, mainly in the spleen, liver, lymphatic glands, and bones, whereas in Niemann's disease the histiocytes in general are said to be infiltrated and transformed into large cells. In Niemann's disease there is a lipoid infiltration of the histiocytes resembling that in diabetic lipaemia and that experimentally produced in animals by a diet containing excess of fat and cholesterol. But as already mentioned, Graham and Blacklock by special technique find that the Gaucher cells give a reaction for lipoids, and therefore suggest that the changes in Gaucher's and Niemann's diseases and the other forms of lipoid histiocytosis are of the same nature, namely, a reaction on the part of the reticulo-endothelial cells to abnormal products of lipoid metabolism, the differences in the several conditions depending for the most part on the nature of the lipoid substances produced.

The relation between Niemann's disease and Gaucher's splenomegaly from a racial point of view presents an analogy with that between the infantile and juvenile types of amaurotic family idiocy. In the

Jews these diseases tend to occur very early in life and to be more rapidly fatal, whereas among gentiles the allied, though structurally somewhat different, changes occur less early in life and are less severe.

DIABETES MELLITUS

The incidence of diabetes mellitus in the Hebrew race is notorious, and the statistics of Joslin, Wallach, von Noorden, and Morrison, and of the records of the Metropolitan Life Assurance Company of New York support this impression. The incidence in Jews has been variously estimated as being from twice to six times as high as in other races. Several reasons are given for this, such as the association with overweight and obesity, excessive eating of food generally and of sweets in particular, a sedentary life, and the highly nervous state so common in the race. Solis-Cohen ascribes the increased incidence of diabetes in Jewish immigrants into the New World to the cruel persecutions the race has for centuries experienced in Russia, which induce a disturbance of the autonomic-endocrine-balance.

The relation between obesity and diabetes mellitus is of interest. That obesity so frequently precedes the onset of diabetes, which may eventually lead to disappearance of the excessive storage of fat, is an established cycle of morbid metabolism. It is clear that they both may be the result of excessive and unsuitable food or of endocrine disorder. The occurrence of diabetes in obese subjects suggests that there is a common metabolic vice which by progressing in a particular manner leads to diabetes, though John's observations on the fasting blood-sugar and tolerance test suggest that there are two groups of the obese; in one diabetes is prone to occur, whereas in the other, which is due to familial tendencies, diabetes is not likely to supervene. The statistics of Anders and Jameson show that among obese persons diabetes follows in 1 out of every 12 gentiles, and in 1 out of 8 Jews, and the question arises whether the great incidence in Jews is due to a higher grade of obesity or to a greater liability to diabetes. Joslin is emphatic that diabetes is largely the penalty for obesity and is more likely to occur the greater the degree of obesity, in fact that a Jew becomes diabetic not in virtue of his race but because he is a fat Jew; for if the Jewish race were specially disposed to diabetes it should

occur in early life, but the Jewish child is not more prone than the young gentile to diabetes, and in fact the incidence of diabetes in Jews exceeds that among gentiles in the 4th and 5th decades only of life. It has been thought by Riesman and others that increased consumption of sugar is responsible both for the rise in the incidence of obesity and diabetes. According to Haven Emerson and Larimore rises and falls in the consumption of sugar in America, England, and Paris are followed with fair regularity within a few months by corresponding fluctuations in the death rate from diabetes. But with regard to overweight and obesity, which precede in many cases at least the onset of diabetes, Friedenwald and Morrison argue that sugar, as apart from other dietetic excesses, cannot be regarded as the only cause for the increased incidence.

The relation of obesity to diabetes has been further shown by the higher blood sugar curves in the fat (Beeler and Fitz; Paullin and Sauls; John), and by Friedenwald and Morrison's observation that among 45 obese Jews 31, or 68 per cent, gave an abnormal blood sugar curve, and that 8 of these were found to have mild diabetes. But that race alone is not the determining factor in producing a high blood sugar curve appears to be shown by Morrison and Ohler who found that among Jews the high blood sugar curves were all in highly strung or emotional individuals.

Obesity is stated to be familial or hereditary in a higher proportion of cases than is diabetes, though Joslin's statistics admittedly lend some support to the hereditary or familial factor in diabetes in Jews. Hereditary diabetes, according to Joslin, has a favourable prognosis, and as a rule diabetes in Jews is not severe, although, as he was surprised to find, such patients do less well than the average, probably because they do not carry out the dietetic directions thoroughly. From the data just given it would appear that the Jewish proclivity to the disease is closely bound up with obesity, though the high pressure of modern life may, especially in the highly-strung Jew, act as an accessory factor. But the question whether the frequency of obesity and so of diabetes in the Jews is entirely acquired and due to wealth and luxury, or whether it is not, in part at least, hereditary and constitutional should not be overlooked.

PENTOSURIA

The rare condition of chronic essential pentosuria is not a disease as it does not, unless detected, give rise to any ill effects; it is a chemical malformation, or inborn error of metabolism in Garrod's happy phrase, like alkaptonuria and cystinuria. It is commonly familial, but not hereditary, and a striking proportion of the reported cases have been in Jews (Cammidge and Howard).

OBESITY

The subject of obesity, which is so common in Jews, is of interest in connection not only with the high incidence of diabetes in Jews but also with other evidence of their special liability to disorders of fat metabolism, as shown by the comparative frequency of Gaucher's splenomegaly and Niemann's disease in Hebrews. The infiltration of the reticulo-endothelial cells with a complex lipo-protein, identified by Lieb as kerasin and closely allied to cerebrin, in Gaucher's disease, and of the same cells with a definite lipoid in Niemann's malady might suggest either (1) an inherent want of vitality in the reticulo-endothelial cells so that they are unable to carry on the metabolism of the infiltrating substance—admittedly a pure hypothesis and contrary to the view that, being overladen with the infiltrating substance, the reticulo-endothelial cells undergo considerable proliferation; or (2) metabolic disturbance, as stated by Mandlebaum and Downey, and supported by Schiff's observation of a lipoid state of the blood serum in Niemann's disease. In obesity the connective-tissue cells, which are distinct from the reticulo-endothelial system, are occupied by neutral fats; whereas the reticulo-endothelial cells tend to be occupied by cholesterol-esters. So although the processes in Gaucher's splenomegaly and in the lipoid-celled histiocytosis of Niemann's disease and diabetic lipaemia differ from that in steatosis, it appears probable that a vice in fat metabolism, whether inherited or acquired, underlies them both. Gaucher's and Niemann's diseases are familial, and hereditary or familial incidence is said to occur in 60 to 70 per cent of the cases of obesity.

The question whether or not obesity in the Jews is purely due to environmental conditions cannot perhaps be finally settled. Environ-

mental influences, using this phrase in a broad sense to include diet and amount of physical exercise, must play a part in producing obesity, but they would obviously act at much greater advantage if there were in addition an underlying factor in fat metabolism. Obesity has been divided into three categories (1) Exogenous or simple, due to excessive feeding, in which the basal metabolism is within normal limits. This purely environmental form also accounts for conjugal diabetes. (2) Endogenous, related to endocrine inadequacy of the thyroid, pituitary, or the gonads, as seen in hypothyroidism and myxoedema, Frölich's adiposo-genital dystrophy and adiposis dolorosa, in women at the menopause and in eunuchs. In this form the metabolic rate is below normal. (3) The constitutional or hereditary form, which has been specially investigated from the metabolic point of view by Strouse in collaboration with Dye and Wang, who from a review of the literature and their own results found that obesity does occur without any relation to the food taken or to endocrine disorder in persons with a basal metabolism within the normal limits.

A distinction should be borne in mind between the hereditary and familial incidence of obesity; for although obesity is familial in perhaps 70 per cent of the cases, this may merely be due to family habits of eating and to the inheritance of a phlegmatic disposition (von Noorden; Tileston). Joslin is extremely sceptical about a fat diathesis, and suggests that in this instance an hereditary factor "may simply mean unusual exposure to an obetic environment," and Preble, from analysis of 1,000 cases, considers that it is almost always due to dietetic causes and not to hereditary errors of metabolism. On the other hand Davenport argues that constitutional and hereditary variations in the method of metabolism and the degree of appetite are essential in the explanation of fat and lean families, and that idiosyncrasies of metabolism are effected through the mechanism of the thyroid, pituitary, and gonads. It might also be urged that just as there is great hereditary variation in the bodily, muscular, and cerebral development, so must there be in the amount of storage of fats. In his experiments on hereditary adiposity in mice, especially females, at or subsequent to maturity with the A^y gene Danforth found that neither environment nor abundance of food primarily determined the obesity, and pointed out that as the trait did not appear until after

birth it presents a peculiarity which those inexperienced in genetics often find difficult to associate with heredity.

Although the medical opinions quoted are adverse to an hereditary factor in obesity, the biological view in its favour must receive due consideration.

Progressive lipodystrophy, described by Barraquer (1907), given this name by Simons (1911), and that of cephalo-thoracic lipodystrophy by Marañon and Soler (1924), is rare in its well-marked forms; Ziegler states that there are approximately 100 cases on record, and reports 7 examples in 5 of which there was diabetes. According to Weber it is possibly less rare in Hebrew than in gentile women, but is not any more confined to one race than is ordinary obesity.

ACROMEGALY

Like some other diseases, acromegaly has been thought to be common among Jews; Davidoff found that 21 of the 100 consecutive patients admitted with acromegaly into the Peter Bent Brigham Hospital, Boston, were Jews, a percentage more than six times that (3.4) of the Jews among the total American population. He quotes Lorand and Maximilian Sternberg as having also noticed the frequency of the disease in Jews. Quite recently L. P. Mark in his "Apologia of an Acromegalic" also raised the question of a special liability of the Jews to this pituitary disease on the admittedly slender evidence that out of 12 fellow-sufferers 4 were members of the Jewish community, and also on the association of acromegaly with diabetes mellitus or glycosuria, which according to various statistics holds good in from 10 to 40 per cent of cases of acromegaly. Some physicians in a position to know have told me that they do not know of any evidence of a higher incidence of acromegaly among Jews than in other nations, and have warned me that any assumption that the *frustes* forms of the condition are common in Jews should be entertained with caution, because more or less prognathism and thick negroid lips are frequent among Jews, especially when compared with Anglo-Saxons. My impression that there is a decided tendency to some excess of anterior lobe pituitarism in the Jewish race is not incompatible with the view, put forward by Keith in his lectures on the evolution of human races in the light of the hormone theory, that the peculiar effects of the

pituitary mechanism are best seen among the modern races of the Caucasian or European type.

HEREDITARY HAEMOPTYSIS

In 1919 Libman and Ottenberg described a new clinical form of haemorrhagic disease in 7 members in three generations of a Jewish family who were the subjects of haemoptysis but had never shown any evidence of tuberculosis. They could not find any signs in their cases of hereditary telangiectases, which, it may be noted, it has appropriately been suggested by Emile Weil should be called Osler's disease. They compared it to the hereditary and familial form of haematuria described by L. Guthrie and W. W. Attlee, in whose articles, however, there was not any statement suggesting that the patients were Jews; the family recorded by Guthrie was afterwards investigated by A. C. Alport and A. F. Hurst, the latter of whom tells me that they were not Hebrews, and Dr. Attlee has definitely informed me that his patients were not. But Guthrie's cases, like Kidd's, and those reported by Kidd, Pel, Eason, Smith, and Buchanan, appear to have been examples of hereditary and familial nephritis. It does not appear that familial epistaxis without telangiectasia, which affects both males and females and is transmitted by both sexes, has any special incidence in Jews (Giffin). Although their cases of haemoptysis were in Jews, Libman and Ottenberg cautiously did not lay any emphasis on the racial incidence, as their observation was practically unique.

A number of diseases have tentatively been thought to be commoner in Jews than in gentiles; among these, although there may not be any convincing evidence, some are intrinsically interesting, such as von Jaksch's anaemia infantum pseudo-leukaemica, idiopathic multiple sarcoma of Kaposi, haemophilia, polycythaemia hypertonica (Weber),[3] Hodgkin's disease (Bunting),[4] dementia praecox, and mongolism; but I do not propose to discuss these or the large question of mental and nervous disorders, and shall in conclusion refer briefly to three conditions—malignant disease, tuberculosis, and alcoholism—which, though occurring, are in some respects modified in the Jewish race.

[3] Weber, F. P.: *Brit. Med. Journ.*, 1927, ii, 98.

[4] Bunting, C. H.: Nelson's Loose-Leaf Medicine, Vol. iii, 356.

MALIGNANT DISEASE

It does not appear that the cancer mortality is lower among Jews than other races; indeed in Russia Gantt's enquiries show that it is higher than in gentiles; but there is much evidence collected by Fishberg, Theilhaber, and Vineberg that uterine cancer, especially of the cervix, is rare in Jewesses. This has been ascribed to observance of the Mosaic law limiting co-habitation during and for seven days after menstruation, and for a period after child-birth, thus ensuring freedom from irritation of the parts when in a state of congestion; Vineberg, who gives this explanation, found that at Mount Sinai Hospital, New York, uterine cancer was 7½ times commoner among non-Jewish than among Jewish women. On the other hand malignant growths of the stomach and alimentary canal are frequent, perhaps more so than in gentiles; the same has been said about mammary carcinoma, but Dr. W. M. Feldman has told me that he has some statistical evidence pointing to the lower incidence of mammary cancer among Jewesses who suckle their children, thus suggesting that when the natural activities of the gland are balked proliferation in a malignant direction is likely to follow. It is interesting to note that among Mexican women of mixed blood the incidence is almost the reverse to that in the case of Jewesses, for uterine cancer is very common and mammary carcinoma rare (Hoffman).

TUBERCULOSIS

The comparative resistance of the Jews to tuberculosis, in spite of adverse environment, life in towns, their narrow chest measurement which would be thought to dispose them to the disease, and their special liability to diabetes which may terminate with pulmonary tuberculosis, has been proved by statistics from various parts of the world by shewing that their mortality rate is lower than that of their gentile neighbours. Even after the privations of the Great War tuberculosis appears to have run a milder course in Jews than in other races (Werner). It is important to realize that whereas the mortality rate amongst Jews is much lower than in Gentiles, this is not true of their morbidity rate.

Various hypotheses have been put forward to explain the resistance

of the Jews to tuberculosis. The attractive view was urged by Fishberg in 1911 that during the eighteen hundred years that they have lived in conditions extremely favourable to tuberculous disease those who could not adapt themselves and become relatively immune were eliminated. In support of this result of natural selection he instanced the high mortality—amounting to nearly a third of the total deaths—from tuberculosis among Viennese Jews in the 17th century. In this connection the possibility of a certain degree of acquired racial immunity might well be raised. The influence of the careful inspection of meat so as to avoid the ingestion of tubercle bacilli was insisted on by Behrend; this probably does diminish the incidence of abdominal, surgical, and generalized tuberculosis, but it would not explain so satisfactorily the resistance to pulmonary infection. Feldman believes that the greater sobriety, comparative freedom from syphilis, and care of children, characteristic of the Jews, play a part, though they are not the sole factors, in this remarkable trait.

ALCOHOLISM

The sobriety of the Jew is proverbial, and the longevity of the race has been ascribed in part at least to this factor. Though sober, the Jews are rarely total abstainers, but they are, or have in the past been, deterred from intoxication by powerful racial influence, for by the Jews of the Ghetto drunkenness was "abhorred as a sin, a disgrace, only fit for a Goe (Gentile), and not fit for one of the chosen people" (Fishberg). Feldman argues that in addition to the fear of social ostracism, the manner in which the Jew takes alcohol, namely always eating something, such as a sandwich or two, before he drinks, protects him from becoming intoxicated, for the absorption of alcohol, which takes place rapidly from an empty stomach, is delayed in the presence of food. As in the case of tuberculosis, so with regard to alcoholism it has been urged that the present sobriety of the Jews is the result of natural selection, gross intemperance in past generations having eliminated those who obtained any satisfaction from intoxication (Archdale Reid). Against this it has been stoutly denied that there is any evidence that the ancient Hebrews drank to excess; further, when the modern Jew cuts himself adrift from the influence of his race he does not remain sober. It would thus appear that the sobriety of

the Jews and the resulting freedom from alcoholic diseases, such as delirium tremens and hepatic cirrhosis, do not depend on an inborn trait but are the result of moral and social influences.

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THE NERVOUS COMPLICATIONS OF MEASLES

With a Summary of the Literature and Publication of 12 Additional Case Reports

FRANK R. FORD

From the Medical Clinic, Johns Hopkins Hospital and Medical School

INTRODUCTION

Almost all of the acute febrile diseases of childhood may be complicated, in exceptional instances, by symptoms referable to the central nervous system. According to Rolleston ("Acute Infectious Diseases," 1925), "encephalitis" occurs in measles more commonly than after any of the other diseases of children, although the incidence is very low even in measles. For example, Boenheim (*Ergeb. d. inn. Med. u. Kinderh.*, 1925, **28,** 598) states that among 5940 cases of measles treated in the various hospitals in Berlin between 1905 and 1925 there were nervous complications in 0.4 per cent, including 8 cases of "serous meningitis," 6 cases of "encephalitis" and 11 cases of unexplained convulsions. There are several reviews of this subject in German and also in the older French literature, but only scattered case reports in English. The pathological anatomy was practically unknown until the recent publication of careful histological studies by Siegmund, Creutzfeld, Guillery, Wohlwill and Sjövall.

By the kindness of Dr. Edwards A. Park, Professor of Pediatrics, Johns Hopkins Medical School, and of Dr. G. F. Powers, Professor of Pediatrics of the Yale School of Medicine, I have been enabled to collect twelve previously unpublished cases in which nervous symptoms appeared in the course of measles. Eight of these were found in the records of the Harriet Lane Home among over 55,000 case histories, and four were obtained from the New Haven Hospital. I shall give these in brief and also attempt to review the extensive literature which deals with this subject. References to a large number of case reports have been omitted either because the description of the illness was so fragmentary as to be of no value or because the connection of the nervous symptoms with measles was improbable.

DIFFUSE CEREBRAL SYMPTOMS OF BRIEF DURATION

Every pediatrician of experience is familiar with cases of measles in which drowsiness, or even stupor, develops on the fourth to the sixth day of the eruption and disappears without any residuum within a few hours. This is associated with a secondary rise of temperature which may reach 105°F. Sometimes the stupor is more prolonged and there may be headache, vomiting, dilatation of the pupils, muscular twitchings and even convulsions. The *tache cérébrale*, stiffness of the neck and a positive Kernig sign may be present, although these so-called meningeal signs are rarely so marked as they are in purulent meningitis. In fact stiffness of the neck is usually merely a part of a general muscular rigidity. A very striking feature of many cases is the excessive irritability which seems to be typical of this condition. It has been emphasized by several authors that there is characteristically a fever-free interval of one or two days, during which convalescence seems to be established, before the onset of the nervous symptoms; but the latter may also appear at the height of the eruption or even, as in case 3 of the writer's series, before the eruption has developed. The spinal fluid (see Table VI) is under increased pressure, but there is usually only a small increase in lymphocytes. The globulin tests are negative or faintly positive. Sugar content is normal or reduced. The terms "meningism" and "serous meningitis" are commonly applied to this clinical picture, but it is evident that the symptoms point to the brain and not to the meninges. This group is characterized by an entire absence of focal signs and by prompt and complete recovery. It suggests an intoxication of the nervous system without anatomical lesions. Cases of moderate severity are usually not considered worthy to be described in medical literature; hence the number of cases in Table I cannot be considered in any way representative of the frequency of this type. The only condition which may be difficult to distinguish from this is the so-called sympathetic or aseptic meningitis resulting from infections of the ear or nasal sinuses.

Case 1 (Ped. 8209). Child of 6 years developed convulsions on the fifth day of measles. Stuporous for several days. C. S. F. contained 130 mononuclear cells. Globulin positive. Rapid recovery without residual symptoms.

TABLE I

Diffuse cerebral symptoms of brief duration

AUTHOR	REFERENCE	SEX	AGE	TIME OF ONSET	CLINICAL PICTURE	C. S. F.	RESULT
Pitt, G. N. Case 1	Trs. Clin. Soc., 1904, 37; 23	M.	19 yrs.	4th day of eruption	Delirium, finally coma, retention of urine; later insomnia, poor memory		Complete recovery in one year
Boenheim, C. Case 1	Ergebn. d. inn. Med. u. Kinderh., 1925, 28, 598	?	5 yrs.	One day before rash	Drowsiness, dilated pupils, 3rd nerve palsy, sl. stiff neck, vomiting		Int. rectus palsy after 3 weeks
Case 2		?	16 yrs.	7th day after defervescence	Coma, positive Kernig sign, convulsions, fever to 40°C.	Pressure plus; cells 0; glob. 0	Recovery in 3 days
Neal, J. B. and Appelbaum Case 1	Jour. Am. Med. Assn., 1927, 88; 1552	F.	6 yrs.	2nd day of disease	Convulsions, stupor, Kernig sign questionable, knee-jerks increased, pupils contracted	Cells increased; glob. +	Recovery in week
Case 2		M.	3 yrs.	9th day of sisease	Vomiting, apathy, headache	Sl. increase in cells; glob. +	Recovery in few weeks
Boenheim, C. Case 1	Berl. klin. Wchnschr., 1927, 33; 1552	M.	4 yrs.	4th day of disease	Apathy, poverty of movement, muscular rigidity	Cells 4; glob. +; pressure +	Slow recovery
Case 2		F.	7 yrs.	5th day of disease	Apathy, negativism, sl. stiffness neck, stereotyped speech	Cells 4; glob. +; pressure +	Recovery in 10 days
Lemierre, Michaux, Limasset	Bull et mém. Soc. méd. d. hôp. de Paris, 1917, 41; 497	M.	?	During eruption	Headache, T. 40.3°, stupor, stiff neck, *anuria*, *bronchopneumonia*, unequal pupils, no ear infection	Turbid; Monos. 80 per cent; lymphos. 20 per cent	Recovery in week
Laroche, G. Quioc	Bull et mém Soc. méd. d. hôp. de Paris, 1923, 47; p. 1841	M.	11 yrs.	5th day of disease	Somnolence, stiff neck, Kernig sign, pupils unequal, fixed, retention of urine, one remission	Cells 208; albumin 75 mgm.	Recovery in several weeks
Denechau, D.	Paris méd., 1918, 29, p. 111	M.	11 yrs.	8th day of disease	Headache, T. 37° for 48 hrs., then rose to 38.6°; drowsiness, vomiting, stiff neck, recurrent eruption; Kernig's sign, ears neg.		Prompt recovery but pale and weak after month and half
Ford, F. R.	Case 1	M.	6 yrs.	4th day of disease	Convulsions, stupor, no Kernig, no stiff neck, no focal signs, T. 101.2°, rapid improvement beginning on 6th day	Cells 130; glob. +	Rapid recovery in 10 days

W. E., boy of 6, was brought to the Harriet Lane Home in stupor on the fifth day of an attack of measles. He had been under observation since the age of 15 months when he had been treated for cervical adenitis and otitis media. At 2 years 5 months he had had typhoid fever and at 3 years 6 months had developed pertussis. Recovery had been complete in each case.

The onset of the measles was attended with cough, coryza, and conjunctivitis. The eruption appeared on the next day. On the third day he seemed somewhat better, but the next evening he was very miserable and cried all night. The morning of the fifth day he had five severe general convulsions, became stuporous and was brought to the hospital.

On examination the child was found to be well developed and well nourished. Temperature 98.6°F. There was a fading measles eruption over the body and a general enlargement of the lymph nodes. The child was very drowsy and could not be roused for more than a few moments. The neck was not stiff and Kernig's sign was negative. The ears were negative except for old scars. The lungs were clear. C. S. F. pressure increased. Globulin positive (Pandy), Wassermann reaction negative. No film formation. Gold curve 1110000000. Cells, 130 mononuclears. Smear negative. X-ray of chest showed slight fibrosis of both upper lobes, probably tuberculous. Skin tuberculin test negative, twice. W. B. C. 22,100.

The first night the temperature was 101.2°F. but soon fell to normal and rapid improvement occurred. On the 9th day C. S. F. showed 23 cells and the globulin reaction was faintly positive. On the 11th day, the cells were 8 and the globulin negative. The next day the patient was discharged on the insistence of his parents. He was seen again three weeks later and once more after two years. Recovery was complete.

MULTIPLE FOCAL CEREBRAL SYMPTOMS

Unfortunately recovery is not always so prompt and evidences of focal lesions of the nervous system may be superimposed upon the clinical picture outlined above. A large variety of syndromes are described including symptoms referable to the cortex, basal ganglia, brain-stem, cerebellum and spinal cord. For convenience it seems best to arrange these in separate groups, but it must be admitted that there is a great deal of overlapping and an exact classification is not possible.

In Table II we include those cases in which there were signs of multiple focal or diffuse lesions in the nervous system. The onset is the same as that in the cases described in the first section. About the fifth day, when the temperature has been normal for twenty-four hours or more and the rash is rapidly fading, the child becomes drowsy

TABLE II

Multiple focal cerebral symptoms

AUTHOR	REFERENCE	SEX	AGE	TIME OF ONSET	CLINICAL PICTURE	C. S. F.	RESULT
Neal and Applebaum							
Case 5	*Loc. cit.*	M.	2½ yrs.	5th day after onset	Convulsions, vomiting, right 6th, 7th nerve palsy, loss of reflexes, loss of vision, Temp. 105°F.	Cells 0; glob. (?)	Death on 12th day; no autopsy
Case 6		M.	5 yrs.	4th day of convalescence	Stupor, dilated, fixed pupils; later, overactivity, petit mal, negativism, convulsions	Cells 15; glob. +	Severe mental defect, petit mal seizures
Brock, J.							
Case 9	Ztschr. f. Kinderh. 1920, 40; 552	M.	6 yrs.	4th day of disease	Stupor, stiff neck, Kernig, papillitis, rigidity, Babinskis, reflexes increased, ankle clonus	Cells 120; glob. ++++	Increased reflexes, sl. pallor of discs
Case 10		F.	6 yrs.	4th day of disease	Stupor, loss of reflexes, retention of urine, dilated pupils, muscular flaccidity, Temp. 41.5°C.	Cells 170; glob. ++++	Death; autopsy
Mosse, K.							
Case 1	Monatschr. f. Kinderh., 1926, 112; 272	F.	5½ yrs.	5th day of disease	Stupor, vomiting, T. 40.2°, fixed pupils, trismus, loss of reflexes, Babinski's (?), muscular flaccidity	Cells 0; glob. +	Death; autopsy
Case 2		M.	5½ yrs.	7th day of disease	Stuporous, fixed pupils, flaccid muscles, reflexes increased, later lost, vomiting	Cells 0; glob. +	Death; autopsy
Boenheim, C.							
Case 4	*Loc. cit.* 1925	M.	3 yrs.	3rd day of disease	Convulsions, loss of speech, left face weak. rigidity of legs, reflexes + ankle clonus, no fever		Spastic weakness of legs
Case 7		F.	7 yrs.		Stupor, loss of muscle tone, twitching, incontinence; later scanning speech, spastic-ataxic gait	Negative	Spastic legs, mental defect
Case 8		F.	7 yrs.	5th day of disease	Apathy, loss of speech, rigid muscles, negativism, restlessness, forced laughter; later hypomanic state	Cells 4; glob. +	Complete recovery in 3 months

Lust, F, Case 1	Monatschr. f. Kinderh., 1926, 34; 284	M.	8½ yrs.	5th day of eruption	Tonic convulsions, somnolence, manic excitement, sluggish pupils, unilateral ankle clonus	Cells moderate increase; glob. +	Complete recovery in few weeks
Case 2	München. med. Wchn schr., 1927, 74; 96	F.	7½ yrs.	7th day of illness	Deep stupor, sluggish pupils, left 7 paresis, nystagmus, papillitis, paresis of left arm and leg, Kernig sign	"Sl. inflam. changes	Sl. paresis of left peroneus after several weeks
Case 4		M.	6 yrs.	During febrile stage	Somnolence; later irresistible sleep attacks, motional lability, mental regression		Mental regression, irritability, sleep attacks
Guinon, L. Case 1	Bull. Soc. de pédiat. de Paris, 1914, 16; 307	M.	4 yrs.	One and a half months afterwards	Stupor, whining, rigidity, later choreic movements, loss of speech, increased reflexes	Normal	Complete recovery in 40 days
Case 2	Arch. de méd. des. enf., 1914, 17; 561	M.	4 yrs.	During convalescence	Headache, stupor, rigidity, reflexes increased, Babinski's, later choreic movements and ataxia	Normal	Rapid recovery in 2 months
Carpenter, G.	Pro. Soc. for Study of Dis. in Ch., April 10, 1908	F.	20 mos.	3 weeks later	Optic neuritis, squint, screaming attacks	Cells 0	"Not so bright as before illness"
Horwitt, S.	Arch. Ped., 1924, 41; 476	M.	6½ yrs.	4th day of disease	Supor, convulsions, "choked disc," conj. deviation to rt., loss reflexes, general rigidity, later manic state	Large increase in cells, glob. +	Overactive and distractible
Lowenburg, H. Schaller, A. L.	Arch. Ped., 1926, 43; 73	F.	4½ yrs.	During eruption	Coma, squint, retraction of head, twitching, Kernig sign, Babinskis, reflexes increased, incontinence	Cloudy; 80 per cent polys.; glob. ++++; film formation	Stubbornness and exhibitions of temper
McLendon, P.	Arch. Ped., 1926, 43; 544	M.	7 yrs.	4th day of illness	Coma, convulsions, general muscular rigidity, Babinskis, sluggish knee-jerks	Cells 16; 75 per cent polys.; glob. +	Complete recovery
Branson, G. L.	Brit. M. J., 1905, i, 941	F.	12 yrs.	3rd day of eruption	Stuporous, convulsion, sluggish pupils; rt. arm and leg stiff; later loss of memory		Irritability for time, but eventually complete recovery

TABLE II—*Continued*

AUTHOR	REFERENCE	SEX	AGE	TIME OF ONSET	CLINICAL PICTURE	C. S. F.	RESULT
Pitt, G. N. Case 2	*Loc. cit.*	M.	4½ yrs.	"After eruption"	Delirium, weakness of arms and legs, speech affected, mental condition impaired, internal squint		After 15 yrs. ataxia and weakness, mental defect
Gibbs, N. Winnicott, D.	Brit. J. Ch. Dis., 1926, 23; 107	M.	4 yrs.	14 days after onset	Irritability, twitching, rigidity	Cells "increased"	Death
Guthrie, L. Smith, J. A.	Pro. Soc. for Study of Dis. in Ch., Oct. 21, 1904	M.	6 yrs.	6th day of disease	Convulsions, coma, rt. hemiplegia, loss of speech, bilateral athetosis, loss of knee-jerks		General athetosis after 8 mos.
Redlich, F.	Ztschr. f. Kinderh., 1927, 43; 178	M.	4 yrs.	3rd day of disease	Unconsciousness, dilated pupils, very sluggish, stiff neck, rigidity, left Babinski, myoclonus of arms, otitis	Cells 0; glob. sl. +; pressure +	Complete recovery in 9 weeks
Todesco, J.	Lancet, 1927, ii; 21	M.	6 yrs.	6th day of disease	Apathy, loss of speech, fixed pupils, fits on rt. side, Kernig sign, difficulty in swallowing	Turbid with polymorphs	Recovery almost complete in 13 days
Allyn, H. B.	Medical News, 1891, 59; 617	M.	13 mos.	17th day of disease	Measles, *pneumonia*, left hemiplegia, stupor, disturbances of speech, mental condition affected		Residual weakness and mental defect
Simonin	Bull. et. mém. Soc. méd. d. hôp. de Paris, 1901, 18; 712	M.	21 yrs.	3rd day of disease	Ptosis of left lid, palsy of both 6th nerves, headache and vertigo		Recovery in 15 days
Trozzi, F.	Malpighi; Gaz. Med. di Roma 1911 36; p. 198 (abstr. Rev. neurol., 1911, 22, 432)	?	8 yrs.	At beginning of convalescence	"Meningeal syndrome," with bilateral 6th nerve lesion, partial 5th and weakness of left arm		Recovery in 2 months
Sotow, A. D.	Jahrb. f. Kinderh., 1899, 50; 1	M.	1 yr.	30 days after onset Some weakness before	General weakness; later tremor of left arm, later other extremities affected, could not walk or stand, reflexes increased, rigidity		Recovery almost complete in 5 months. Still sl. tremor

Calmeil	Traité des mal. inflam. du cerveau. t. 2, p. 411 (cit. by Denarie)	M.	3 yrs.	During convalescence	Convulsions 12 hrs, loss of speech, sight, and hearing; return of hearing in 15 days, paralysis of right hand		After 19 yrs. blind, idiot, epileptic. Autopsy: atrophy l. hem.
Abercrombie	"Des mals de l'encéph. et de la moëlle épin." Paris 1835, Obs. 72 (cit. by Imbert-Gourbeyre: Gaz. Méd. Par., 1863, 18; 418	F.	2½ yrs.	During convalescence	Sudden paralysis of legs, stupor, squint, convulsions; later coma, dilated pupils rapid improvement		Recovery in 3 weeks
Nebel	Acta phys. med. Acad. Caesarae naturae curiosorum, p. 296, Obs. CXL (cit. by Denaire)	F.	40 yrs.	At disappearance of eruption	Severe pains above eyes, drooping of both eyelids		Recovery
Henoch, E.	Vorlesung über Kinderh., 1892, p. 276	M.	6 mos.	Soon after measles	Convulsions, weakness of arms and legs, general rigidity; could not walk or stand, choreic movements, stuttering		Death at 6 yrs. Autopsy: atrophy of frontal lobes meningeal thickening
Eich, H.	"Die Encephalitis als Komplikation u. Nachkrankheit der Masern," 1915	M.	6½ yrs.	3rd day of eruption	Stupor, T. 40°, incontinence, paralysis of extremities, increased reflexes, clonus; later, general ataxia, staccato speech		After 11 mos. stupid face, scanning speech, unsteady station, mental defect
Ford, F. R. Case 2		M.	5 yrs. 10 mos.	Gradual onset during convalescence	Apathy, general weakness, loss of speech, loss of reflexes, slow improvement, speech scanning, spastic-ataxic gait		General convulsions after 6 yrs, tremor of hands, irritability
Case 3		M.	3 yrs.	2 days before eruption	Convulsions, loss of speech, right hemiplegia; later, petit mal, and profound mental changes		After 1 yr. and 4 mos. Mentally defective petit mal, destructive

TABLE II—*Continued*

AUTHOR	REFERENCE	SEX	AGE	TIME OF ONSET	CLINICAL PICTURE	C. S. F.	RESULT
Case 4		F.	1 yr.	6th day of illness	Focal convulsions, stupor, left hemiplegia; later petit mal, irritability, screaming spells		Petit mal and mental defect
Case 5		F.	8 yrs.	5th day of illness	Drowsiness, general weakness and ataxia of cerebellar type, reflexes increased, clonus	Cells 35; glob. 0	Gait unsteady, reflexes increased, ankle clonus after 9 weeks
Case 6		F.	5 yrs.	5th day of illness	Drowsiness, convulsions, coma, rigidity, fixed pupils, Babinskis, stereotyped talk	Cells 15; glob. 0	Persistent personality change
Case 7		F.	3 yrs.	5th day of illness	Drowsiness, irritability, convulsions, transient left hemiplegia, bilateral Babinski, abusive language	Cells 138; glob.+	Rapid recovery
Case 8		F.	9 yrs.	5th day of illness	Delirium, rigidity, stupor, bilateral Babinski, ankle clonus, tremor	Cells 60; glob.+	Slow but complete recovery
Case 9		F.	3 yrs.	6th day of measles	Convulsions, stupor, rigidity, clonus, partial left hemiplegia, aphasia	Cells 42; glob.+	Persistent mental defect
Case 10		F.	6 yrs.	5th day of illness	Sudden general convulsions, stupor, rigidity, aphasia, choreic movements, reflexes increased	Cells 15; glob. 0	Complete recovery

and irritable. Convulsions develop and are followed by stupor. There is a sharp rise in temperature. During the stupor there is usually general muscular rigidity. Myoclonic twitching is common. The pupils may be dilated and fixed. Respiration is sometimes slow or irregular and Cheyne-Stokes breathing is described. There is very frequently congestion or even moderate oedema of the optic nerve heads. The spinal fluid shows the changes described above. After several days or more there is a gradual clearing of consciousness and various neurological disturbances are revealed; including spastic weakness of the extremities, tremor, choreic or athetoid movements, aphasia, and ataxias. Mental disturbances are usually prominent. Unmotived screaming, irritability, excitement, abusive language, stereotyped speech and emotional reactions are mentioned. Recovery from these symptoms is usually slow and incomplete.

The clinical picture may closely resemble that of epidemic encephalitis or tuberculous meningitis, and the differentiation may be difficult. The latter may usually be recognized by its slowly progressive course to a fatal termination with rising cell count and gradual fall of spinal fluid sugar even if tubercle bacilli are not found. The former may offer more difficulty because of the great variety in its clinical manifestations, but the tendency of epidemic encephalitis to run a chronic, progressive course with the appearance of new symptoms months after the onset should make it possible in most instances to distinguish it from the condition under consideration in which there is always a strong tendency to improvement.

Complete recovery took place in about 14 of the 42 cases in this group. In 15 cases there was residual mental defect or personality change; in 4 cases epilepsy followed, and in 11 cases there was some remaining disturbance of motility. Five patients died. In the case described by Sotow the child showed the rare syndrome termed "acute tremor." Narcolepsy followed in 1 case.

Case 2 (Ped. 18248). Child of 5 years and 10 months. Gradual loss of speech, general weakness and finally stupor during convalescence from measles. Six weeks later could not sit up or hold up head. Gradual improvement. Spastic gait. Six years later general convulsions and personality changes. Intelligence fair. No neurological disturbances.

J. L., a boy of 5 years and 10 months, had a severe attack of measles. He was

in bed three days and was then permitted to play about the house, but he did not seem to improve. He refused to eat, complained of headache and seemed dull and irritable. On about the tenth day he went to bed again and soon became stuporous. There was no fever or vomiting. The neck was not stiff but the legs were noted to be rigid. Five other children in the family had measles at the same time, but in none of them was there any evidence of nervous system involvement.

Examination three weeks after the onset revealed a poorly nourished boy who was very dull and querulous. When addressed, he did not answer, but whined almost continually. The skin showed small pigmented areas, remnants of the previous eruption. The ears were normal. The chest negative. The neck was not stiff, and Kernig's sign was absent. No disturbance in the cranial nerves could be made out, except for some slight hyperemia of the optic discs, which however, were not elevated. There was apparently a good deal of general weakness of the extremities and the right arm was weaker than the left. Both legs were slightly rigid. The left knee-jerk was feeble; the right absent. No clonus was elicited. Medical examination revealed no disease in the chest or abdomen. W. B. C. 9,200. Skin tuberculin test negative. C. S. F. Cells 7. Globulin O. Wassermann test negative. Gold curve 00000000000. Urine: albumin +. Sugar 0. No pus. Blood culture negative. Widal negative.

On about the twenty-fifth day, the spinal fluid contained only four cells and the white blood count was 8,600.

About six weeks after the onset there was but little improvement in strength. The child still seemed mentally confused and mumbled incoherently all the time. All four limbs could be moved but the strength was very feeble. The child could close his fingers but not open them.

Seven weeks after the onset, speech had returned but was of a scanning character. The child could not sit up nor even hold up his head. The left ankle was extended and could not be flexed. There was still no sphincter control.

Nine weeks after the onset, speech was nearly normal. The child could stand and walk, but the gait was spastic especially in the left leg. He was discharged eleven weeks after the onset in about the same condition.

One year after the illness, his intelligence seemed good, but he was nervous and irritable. The gait was still slightly spastic.

Seven years after the measles, the patient was reexamined. He was very restless and irritable and there was a fine tremor of the hands. For one year he had been having general convulsions with loss of consciousness. There were frequent headaches. Neurological examination was essentially negative. Ophthalmological examination revealed no lesion of the retinae or optic nerve heads, but there was a refractive error. Glasses were prescribed which gave considerable relief from the headaches. Psychiatric examination revealed a mental age of 10 years (true age 13).

Case 3 (Ped. 49847). Child of 3 years. High fever, convulsions and right hemiplegia 2 days before the eruption of measles. Recovery from hemiplegia, but speech

was defective and mental defect was evident after a year and four months. Petit mal seizures and convulsions at long intervals.[1]

D. G., a boy of 3 years, the second child of healthy parents, developed a fever of 104°F. without obvious cause. His elder brother had had measles three weeks before. General convulsions soon developed and lasted for almost two hours. The next day it was noted that the child could not move his right arm or leg. Speech was lost at the same time. On the third day, a typical measles eruption developed. The temperature was 104°F. for two days and then 101°F. for two more, reaching normal at the end of a week. The child was kept in bed for three weeks. The right arm and leg gradually improved in strength and he was able to walk in four weeks. Speech improved much more slowly and there was evident change in personality. Before the illness the child was nervous and irritable, but bright and quick to learn. Since the illness he has been abnormally placid, but disregards attempts at training and discipline. He soils himself frequently, eats soap and other things unfit for food, and seems demented.

Examination two months after the illness showed a well developed well nourished child of 3 years of age. No evidences of focal injury to the nervous system could be demonstrated. The cranial nerves were intact. There was no residuum of the former weakness of the right arm or leg. The child made no effort to speak. The reflexes were all normal. Behavior, however, was definitely disturbed. The child's expression was somewhat blank, and he showed a constant purposeless restlessness. During the examination there were numerous brief pauses in the patient's activities which suggested petit mal attacks. The general physical examination was negative.

Five months after the illness there was some improvement; the child could speak some few words and would sometimes obey. He was very mischievous and had incontinence. Petit mal seizures were still very frequent.

Seven months after the onset, petit mal attacks were less frequent.

One year and four months after the illness, the petit mal seizures had ceased, and some mental improvement was evident. Speech was still very imperfect and the child could repeat a few words, but did not talk spontaneously. He was very restless, destructive and disobedient. At night he would stay awake and was very noisy. General convulsions occurred at long intervals.

Case 4 (Ped. 30538). Girl of one year developed severe left-sided convulsions several days after the onset of measles. Left hemiplegia followed and eleven months later petit mal attacks developed and personality changes appeared.

E. M., a healthy girl of one year, developed measles with moderate fever and eruption which lasted two days. Convalescence seemed to be well advanced on about the sixth day when left-sided convulsions developed and continued for several hours. After this, the child was stuporous and very ill for several days.

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[1] This case is included by the courtesy of Dr. Paul Shipley.

A left hemiplegia was noted soon after the convulsions ceased. For a month the paralysis was complete and then it gradually improved. At the age of one year and eleven months momentary seizures were observed, in which the child would pause, roll up her eyes and make swallowing movements of the throat. After these seizures she usually seemed drowsy and would often go to sleep. On an average the attacks occurred six to eight times a day. The child had grown irritable and disobedient and subject to screaming spells.

Examination at the age of two years showed a well developed and well nourished child. Neurological examination entirely negative. The mental condition was apparently normal and the child seemed bright and playful. Medical examination was negative. A month later the attacks were more frequent. Rontgenograms of the spine and skull showed no abnormalities.

Case 5 (Ped. 55792). Colored girl of 8 years developed drowsiness and inability to walk soon after the eruption faded. On the 5th day drowsiness and general ataxia of cerebellar type. Bilateral ankle clonus. C. S. F. Cells 35. Pressure 100 mm. Severe pyelitis and kidney abscess during convalescence, requiring operation.

T. S., a colored girl of 8 years, was brought to the Harriet Lane Home December 20, 1927, because of drowsiness and inability to walk. One parent had died of pulmonary tuberculosis, and the other of some unknown bladder trouble. One sister, 13 years old, was living and well. The patient's previous history was unimportant, except for the fact that she had always been small and under her proper weight.

About December 15 the child had complained of headache and seemed ill. A few days later she developed a skin rash over the face, back and chest. There was running from the nose and eyes. After three days the eruption faded and the child seemed better, but soon afterwards she developed a high fever and vomited. The next day she was very drowsy and it was found that she could not walk. She was then brought to the hospital. The family were unable to give exact dates and it was difficult to obtain a very satisfactory history, but the sequence of events seems to have been substantially as indicated above.

Examination revealed a colored girl of 8 years, poorly developed and much under weight. She was evidently very sick. There were faint traces of the eruption to be seen on the chest, but no desquamation. Although the patient was very drowsy, she could be easily roused and would try to cooperate in the examination. The pupils were moderately dilated but equal, and reacted well to light. The optic discs were somewhat hyperemic and the vessels of the retinae seemed slightly engorged. The other cranial nerves were apparently normal. There was marked general weakness, but no definite paralysis. All movements of the arms and legs were ataxic, apparently more so than the weakness would explain. The child could not walk or stand without support. The disturbances of coordination were very suggestive of cerebellar ataxia. There was no stiffness of the neck and no Kernig's sign. No sensory loss could be made out. The tendon

reflexes were brisk in the arms and legs and an ill-sustained ankle clonus could be obtained on either side. The plantar response was of the flexor type. The general medical examination revealed very little. The pharynx was slightly injected. The chest and abdomen were negative. A careful examination of the ears was negative. There was a profuse vaginal discharge.

Laboratory examinations were as follows: Blood: Hb., 75 per cent. R. B. C., 4,790,000. W. B. C., 12,520. PMN 52 per cent, S.L., 32 per cent, L. L., 4 per cent T. & M. 12 per cent. Culture from throat negative for *B. diphtheriae*. Smear from vagina showed abundant gonococci. Urine clear. Albumin 0. Sugar 0. A few white cells in sediment. Dec. 20: Spinal fluid: Pressure normal. Cells, 3 lymphocytes. Globulin 0. Mastic curve 00000000000. Dec. 22: Spinal fluid: Pressure 100 mm. Cells 35 lymphocytes. Globulin 0. Wasserman test negative. Sugar 74 mgm. NaCl 700 mgm. Jan. 2: Spinal fluid: Pressure normal. Cells 3. Globulin 0. Culture negative. Gold curve 1222000000. Sugar 108 mgm. Blood Wassermann negative. Roentgenogram of chest showed enlarged lymph nodes in upper mediastinum and root infiltration suggestive of tuberculous infection. Tuberculin skin test strongly positive with 0.1 mgm. Blood pressure 100/60.

The child gradually improved for several days. Temperature varied between 37° and 38°C. The ataxia seemed to be less evident and the drowsiness was clearing up on Dec. 25: On Jan. 2, the temperature suddenly rose to 40.6°C. and the urine was found to contain pus. Tenderness and muscle spasm were found in the right flank. W. B. C. 20,000. Jan. 9: An abscess in the right kidney was opened and the kidney pelvis drained. Gradual improvement followed and by Jan. 22 the temperature was normal although there was still pus in the urine.

February 21: The child's general condition was much improved but she was still very weak and under weight. Neurological examination revealed increased tendon reflexes in the legs, bilateral ankle clonus, equivocal plantar responses and a very unsteady gait which may have been due in part to the weakness. The cranial nerves were normal.

Case 6 (N. H. H. 15305). Girl of 5 years grew drowsy on the 5th day of measles. On the 10th day convulsions and coma. General rigidity, fixed pupils, bilateral extensor response and stupor on admission. Gradual improvement. Sterotyped talk. Persistent personality changes.

M.D., a small girl of 5 years was said to have had measles at 3 years of age. On December 27, 1923 she had coryza and a cough and on the next day a typical measles eruption appeared. Temperature was 103°F. On the 30th the rash began to fade and the temperature fell, but the child did not seem to show a corresponding improvement. January 1, she seemed to be drowsy and the next day she was delirious. On the 5th there were several seizures in which the eyes rolled up and the child was unconscious. That afternoon she became stuporous and was brought to the hospital.

Examination revealed an emaciated girl of 5 years who lay stiffly extended in bed in deep coma. T. 39.6°C. P. 130. There were purposeless movements of the arms, and fine twitchings of all the muscles as if the patient were having a chill. Passive movements encountered a good deal of resistance. Pupils dilated and fixed. The tendon reflexes were all increased. The plantar response extensor on both sides. Abdominal reflexes could not be obtained. Respiration slow and irregular. A fading measles rash could be made out over the face and body. Optic fundi apparently normal.

On the 7th, the child could be partially aroused, and would put out her tongue when requested. There was a coarse tremor of the the right arm. Whenever the patient fixed an object with her eyes, the upper lids were retracted so as to show the cornea above the iris. The tendon reflexes were increased, and there was a bilateral Babinski reflex.

C. S. F. Cells 15 monos. One P.M.N. Pandy 0. Wassermann negative. Urine negative. W. B. C. 12,000; 73 per cent P.M.N. Tuberculin skin test negative. Throat culture negative. Blood Wassermann negative. Roentgenogram of the chest negative.

On the 11th, the child was still drowsy, but much clearer. She could talk distinctly. Neurological examination showed no change. The child slept in the day, but was restless at night. Improvement was very slow. On the 24th the plantar response was equivocal. On the 30th the child was talking freely, but repeated the same phrases in a stereotyped way. In reply to any question she would say, "Ice Cream and cookies. That's all." At times she screamed without pain or apparent anger. February 12, neurological examination was negative. The child seemed bright and talked freely without any tendency to perseveration. She still soiled her clothes, but otherwise her behavior was thought to be normal. She was discharged on that date.

May 15, 1924. The child was reëxamined. No neurological disturbances were evident. Her mother had noted many changes in behavior, however. The child had been very irritable and destructive. She broke her toys, bit her mother without cause and flew into tantrums with little provocation. Her appetite was excessive. On several occasions she had left home with strangers and had had to be brought back. Apparently there was a marked defect in the personality.

Case 7 (U. 17427). Girl of 3 years developed convulsions on the 5th day of measles followed by transient left hemiplegia. Retraction of head, intense irritability and bilateral extensor response on 6th day. C. S. F. Cells 138. Globulin +. Rapid recovery in a few days.

L. M. F., a healthy little girl of 3 years, developed conjunctivitis March 13, 1928. Two days later her mother noticed that she had red spots all over her body and a physician made a diagnosis of measles. The next day, the 16th, the child seemed lively and did not want to stay in bed. On the 17th, however, she was cross and had no appetite. On the succeeding day she seemed drowsy and that afternoon a

general convulsion occurred which seemed to start in the left side of the body. The child was drowsy and confused for an hour after this, but later grew excited and did not sleep that night. On the morning of the 19th she had another convulsion, which was very severe and lasted about an hour. The head and eyes were turned to the left and the left arm and left leg were chiefly affected. For a few hours after this seizure there was a left hemiplegia. Lumbar puncture was performed by the attending physician and 140 lymphocytes per cmm. were found. The child was then admitted to the hospital March 19 at 11 a.m.

On examination she was found to be well nourished and well developed for her age. Temp. 100°F. Pulse 120. She lay still with open eyes and retracted head apparently in a stupor, but cried out when disturbed. The skin showed a faded measles rash with some pigmentation. There was moderate congestion of the conjunctivae, but the throat, nose, ears and chest were negative. There was a moderate enlargement of the lymph nodes. Despite the retraction of the head there was no real stiffness of the neck. Kernig's sign was not definitely positive, but suggestive. No weakness of the arms or legs was discovered. The tendon reflexes were all brisk and equal on the two sides. No clonus. Abdominals, equal. The plantar response was questionably extensor on the right side, but inactive on the left. Muscle tone apparently normal. No changes could be seen in the optic discs except for a slight dilatation of the veins.

The laboratory findings follow: R. B. C. 4,700,000 W. B. C. 19,100. PMN 66 per cent. L.L. 18 per cent. S. S. 9 per cent. T. 3 per cent. Unclassified 4 per cent. Roentgenogram of chest negative. Skin tuberculin test (0.01 mg.) negative. Throat culture showed many alpha hemolytic streptococci. Cultures from the nose were negative. C. S. F. Clear. Cells 78; mono. 74, poly. 4. Globulin (Ross-Jones) negative. Sugar 27 mgm. Pressure 140 mm.

On the afternoon of the day of admission (March 19), the child seemed drowsy, but would awake with a cry every few minutes. There were two brief convulsions involving the left side of the body. That night she was quiet but did not sleep. The next morning she was very irritable, crying out when disturbed and resisting examination. She used all the bad language she knew. The Kernig was still questionable. There were no further convulsions, and no changes in the physical findings. W. B. C. 26700. B. P. 95/45. Temp. 102°F. P. 128. R. 26. C. S. F. Slightly blood-tinged. Cells 138, all mono. but 2. Globulin (Pandy),? Pellicle formed on standing. No tub. bacilli found.

March 21. Temp. 99.2°F. P. 100. R. 28. W. B. C. 24,700. The child lay quietly when not disturbed, but when approached would cry out suddenly. There was great irritability to all stimuli, and some photophobia. No stiffness of the neck or Kernig sign could be demonstrated. The right pupil was larger than the left, but the cranial nerves were otherwise intact, and no disturbance of motility could be found. Tendon reflexes brisk. The plantar response was of the extensor type on both sides, but no clonus was obtained. Rapid improvement occurred in the next few days and on March 24, the child was cooperative, but still fretful

when disturbed. Neurological examination was entirely negative. Subsequent course uneventful and recovery complete.

Case 8 (N. H. H. 53911). Girl of 9 years became delirious on 5th day of measles. On examination, stupor, rigidity, bilateral extensor response, ankle clonus and loss of knee-jerks were found. Cells 60. Pandy + +. Slow but complete recovery.

C. W., healthy girl of 9 years, developed headache, fever and watery eyes on May 4, 1926. On the 5th, a measles rash appeared and spread slowly. On the 8th the child seemed better and the temperature was normal. The next day the child was drowsy and seemed to be delirious. Temperature 105°F. Twitching of the muscles was noted. That afternoon the child was brought to the hospital.

On examination the child was well nourished and developed. She seemed to be stuporous, but could be aroused and was then very irritable. Temperature 105°F. Fading eruption over face and body. The arms were very rigid and movements of the arms were jerky. The legs were not rigid, but there was some stiffness of the neck. Tendon reflexes were somewhat increased in the arms, the left knee-jerk was active, the right knee-jerk was absent and both ankle-jerks were present. The abdominals were active. The plantar response was equivocal. No clonus. The ears were negative. No definite signs were made out in the chest.

Roentgenogram of the chest negative. C. S. F. clear. Cells 60. Pandy + +. Culture negative, W. R. negative. W. B. C. 11,500. R. B. C. 4,000,000. Tuberculin Skin test (0.1 mg.) negative. Urine negative. Throat culture showed Staph. aureus. Blood culture negative.

On the 10th, the child seemed brighter, but later in the day became comatose. T. 39.9°C. Respiration became rapid (140), and the intercostals seemed weak. A bilateral ankle-clonus was elicited, but the other signs were unchanged. C. S. F. cells 65. Pandy + +. On the 12th the child was still stuporous; T. 39.1°C. Both the legs and arms were spastic and tremulous. The fundi showed no change. On the 14th the child could talk a little. A bilateral Babinski reflex was elicited. Temp. normal. On the 17th some improvement was apparent. The child was slow but would answer questions correctly. May 21 chickenpox developed, and ran a mild course without any complications. May 29, the child was discharged. Neurological examination was negative. The child was still slow, but did not seem to be stupid.

Case 9 (N. H. H. 34138). Girl of 3 years developed convulsions and stupor on the 6th day of measles. On examination, general rigidity, bilateral ankle clonus, partial left hemiplegia, and aphasia were found. C. S. F. Cells 42. Globulin +. Gradual improvement with persistent mental defect.

A. S., healthy child of 3 years, was brought into the hospital July 28, 1924 because of osteomyelitis of the left femur. An operation was performed, but the child was very ill and the blood culture was positive. August 6: The upper end of the left humerus was similarly involved and another operation was necessary.

Several transfusions were required. A third operation was performed Nov. 4 to remove infected bone in the femur, but was not entirely successful, and a discharging sinus remained. Nov. 24 the child developed scarlet fever and was promptly treated with antitoxin. The rash faded in a few hours and the fever fell by crisis. Recovery was prompt.

On Dec. 27, 1924, the child developed fever, coryza and spots on the buccal mucosa. On the 31st, a typical measles eruption appeared. On Jan. 2, 1925 the temperature fell to normal and the child seemed better. The rash was fading. On Jan. 3 three convulsions appeared without warning and the child fell into a stupor. The convulsions involved the left arm and leg more than the right.

C. S. F. clear. Cells 19; 15 mononuclears and 4 polynuclears. Globulin +. Pressure increased.

Jan. 4. The child was still stuporous. There was general rigidity of the extremities. The optic discs were hyperemic with blurred margins and dilated veins. Three convulsions occurred during the day. W. B. C. 15,000, 92 per cent PMNs. C. S. F. blood-tinged.

Jan. 5. The child is apparently in coma. Does not respond in any way. Both eyes are deviated to the right and there is a slight internal squint. The pupils are dilated, but react. A bilateral ankle-clonus could be obtained. Both arms and legs are flaccid, and the left arm and leg are not used spontaneously. Roentgenogram of the chest negative. Ears negative.

Jan. 9. The child is stuporous and does not respond. Neurological signs unchanged. C. S. F. clear. Cells, 42, 80 per cent mononuclears. Globulin +.

On Feb. 21, the child was still very dull, and apparently aphasic. She was transferred to the surgical department because of the draining sinuses in the arm and thigh. In October, the right radius became involved and an operation was performed. Chickenpox developed Jan. 12, 1926. Numerous operations finally cleared up the bone infections and on May 1, 1926, the child was discharged. At that time she showed no definite neurological signs, except for loss of speech.

August 18, 1927, the patient was reexamined. She was definitely defective mentally. Her mother said that she was difficult to control, soiled herself, ate things unfit for food and had spontaneous tantrums. She could say only a few words and those were difficult to understand. No disturbance of motility, sensibility, reflexes or cranial nerves were found.

Case 10 (N. H. H. 15764). Girl of 6 years on the 5th day of measles developed general convulsions and became stuporous. Later there was general rigidity, and twitching of the right side of face. 15 cells in the spinal fluid. Aphasia and choreic movements during convalescence. Complete recovery.

V. W., a healthy girl of 6 years developed prodromal coryza on Feb. 14, 1921. On the 16th the eruption appeared and was fully developed on the 18th. There was some fever on the first two days of the eruption, but on the 18th the child seemed better and the temperature was normal. On the 21st a general convulsion

occurred without warning and the muscular twitching persisted for over an hour. Severe convulsions occurred at almost hourly intervals, thereafter and the child did not regain consciousness in the intervals. She was brought to the hospital in the afternoon.

Examination showed a well nourished and well developed little girl in deep stupor. T. 40.2°C. P. 130. There were clonic twitchings of the right side of the face and the right arm at frequent intervals. At times these movements spread over the entire body. Respiration was irregular and of the Cheyne-Stokes type. There was some generalized muscular rigidity. The tendon reflexes were all somewhat increased. Pupils were large, but reacted well to light. The skin showed the pigmented residue of an extensive measles eruption. The thoracic and abdominal viscera seemed normal.

Urine negative. C. S. F. clear. Cells 15. Globulin 0. W. B. C. 26,000. PMN. 90 per cent.

On the 22nd, there were some signs of returning consciousness. No convulsions. Some weakness of the right side of the face was now evident. The child's eyes were widely opened and the upper lids retracted. She did not talk, but made strange grimaces. T. 39. 1°C. P. 120.

On the 23rd the child was much clearer. There was weakness of the right side of the mouth and marked speech disturbance. Active choreic movements of the face and of the right arm were noted. The abdominal reflexes were active. The knee-jerks were sluggish, but the other tendon reflexes were normal. Plantar response was flexor.

On the 25th marked improvement was evident, and there was only slight disturbance in speech. Temperature normal since the 23rd. Recovery was rapid and complete.

HEMIPLEGIAS AND APHASIAS

In the third group single focal cerebral lesions are included. Hemiplegia and aphasia are the commonest symptoms. Unfortunately, the histories of the onset are defective in many instances because the patients were not seen until years afterwards. However, it is clear that the hemiplegia may remain as the only residual sign of a process originally widespread, as in the cases described in Table II; or it may appear without warning as if due to a single vascular lesion. In the latter case, there are usually focal convulsions on the side of the paralysis and unconsciousness of brief duration. Among the 27 cases included in this group there were 3 in which the paralysis was transient, lasting 8 hours, 3 days and 8 days. Recovery was complete in only 8 instances. One patient was not followed. One died. In the remaining 17 cases the results were identical with those of infantile

hemiplegia due to other causes. There was usually defective development of the affected limbs. Mental defect was noted in 4 cases, choreo-athetoid movements in 2, and epilepsy in one case. In 6 cases speech was defective when the child was last seen.

Complications were frequent in this group, scarlet fever, mumps, bronchitis, otitis media being mentioned. In cases complicated by pneumonia it is always possible that the hemiplegia is due to the latter and not a direct result of the measles. Forster (*Jahrb. f. Kinderh.*, 1898, **48,** 86) has published a case of this type in which hemiplegia was caused by an embolus from a ventricular thrombus. Other similar cases have been published. Nephritis is unusual after measles so that we can not consider uremia a factor as it is claimed to be in the hemiplegia following scarlet fever. In general it is probable that the hemiplegias with apoplectic onset bear a somewhat less direct relation to the measles than exists in the other groups of cases described in this paper. Probably they result from the non-specific effect on the vessel wall which occurs in any febrile illness (Ford and Schaffer. *Arch. Neurol. and Psychiat.*, 1927, **18,** 323). Cerebral abscess may cause some difficulty in differential diagnosis especially if papilledema is absent.

Case 11 (Ped. 15336). Healthy child of 1 year and 9 months, developed focal convulsions and right hemiplegia on the seventh day of measles. Two weeks later weakness was still severe. Rapid improvement. Six weeks after onset patient was well except for slight residual hemiplegia.

J. S., a boy of 1 year and 9 months, whose health had previously been good, developed fever and coryza. The next day the measles eruption appeared and lasted five days. Three other children in the household had measles at the same time. The course was not especially severe, but on the seventh day the patient developed seizures in which he was unconscious and twitched all over. These had occurred on an average of seven or eight times a day since then and the parents had noticed that the right arm and leg were weak.

When examined in the clinic two weeks after the onset the child was found to be well developed and well nourished but somewhat dull. The cranial nerves were intact. There was a severe flaccid weakness of the right arm and leg, but no complete paralysis of any muscle group. The child made no attempt at speech. Neurological examination was otherwise entirely negative. The general physical examination was negative. Blood Wassermann test was negative. The urine contained a trace of albumin but was otherwise normal. C. S. F. contained one cell. Globulin 0. Wassermann reaction negative. Skin tuberculin test negative.

TABLE III

Hemiplegia and aphasia

AUTHOR	REFERENCE	SEX	AGE	TIME OF ONSET	CLINICAL PICTURE	C. S. F.	RESULT
Gilman, W. R.	Boston M. and S. J., 1903, 149; 177	M.	9 yrs.	6th day of disease	Coma; later confusion, loss of speech, and understanding of spoken words		Recovery in few weeks
Pitt, G. N. Case 4	*Loc. cit.*	F.	11 yrs.	"With measles"	Prolonged stupor, aphasia for months and mental defect		Mental defect
Bernhardt, M.	Virchow's Arch., Anat. 1985, 102; 26	F.	7 yrs.	During convalescence	Focal convulsions on rt. Rt. hemiplegia, loss of speech, personality change		Mental retardation, and speech defect, after 3 months
Osler, W. Case 32	"Cerebral Palsies of Children," Philadelphia, 1898	?	18 mos.	"After measles"	Otitis, convulsions, left hemiplegia		At 25 yrs., left hemiplegia; convulsions at long intervals
Case 82		?	2 yrs.	2nd day of eruption	Convulsions, rt. hemiplegia, loss of speech; later, choreic movements on rt. side		Choreic movements of rt. arm. The leg recovered
Case 1		?	1 yr.	"Following measles"	Right hemiplegia		At 14 yrs. rt. arm stiff, gait spastic, loss of k. k.
Case 37		?	18 mos.	"During early stages"	Convulsions, unconsciousness, vomiting, right hemiplegia, loss of speech		At 3 yrs., loss of speech, rt. arm weak, mental defect
Sympson	Brit. M. J., 1890, i; 283	F.	3½ yrs.	"During attack"	Right hemiplegia and aphasia		At 13 yrs. speech defect, rt hemiplegia, flaccid, loss of reflexes on rt.
Carpenter, J. S.	Med. News, 1892, 60; 183	F.	3 yrs.	3rd day of disease	*Scarlatina;* 3 weeks later, measles, coma, weakness of rt. arm and leg, ataxia; no aphasia		Complete recovery

Baxter	Med. Repository, 8; 107 (cit. by Allyn)	?	child	At height of disease	Delirium, right hemiplegia		Complete recovery in 26 days
Freud, S., and Rie, O.							
Case 4	Beitr. z. Kinderh., 1891, 3; 195	M.	5 yrs.	In course of disease	Right hemiplegia		At 5 yrs. athetosis and weakness of rt. arm and right leg
Neal and Applebaum							
Case 3	*Loc. cit.*	M.	7 yrs.	6th day of disease	Apathy, paralysis of left arm, hyperesthesia	Bloody	Complete recovery in 12 days
Case 4		M.	20 mos.	15th day of disease	Measles, bronchitis, left hemiplegia, optic discs hazy	Cells 0; glob. +	Death on 30th day. No autopsy
Boenheim, C.							
Case 3	*Loc. cit.*, 1925	M.	1½ yrs.	4th day of disease	Convulsions; rt. hemiplegia, large right pupil		Recovery not quite complete in month
Case 5		M.	23 mos.	At onset of disease	Rt. hemiplegia and aphasia		After 8 mos. weakness and aphasia; no mental defect
Case 9		F.	9 yrs.	Soon after onset	Congenital diplegia; measles, coma, rt. hemiplegia, rt. pupil fixed, optic discs hazy, hypomanic state	Cells 10; glob. 0	Residual hemiplegia and mental defect
Lust, F.							
Case 3	*Loc. cit.*	F.	2 yrs.	4 days *before* eruption	Convulsions, left hemiplegia, flaccid, at first, later spastic		Residual hemiplegia (?)
Winnicott, D. W. Gibbs, N.	*Loc. cit.*	M.	14 mos.	14 days after onset	Irritable, unable to sit up, slow athetoid movements of right arm	Cells not increased	
Sorel	Bull. et mém. Soc. d. hôp. de Paris, 1881, 18; 193	F.	2½ yrs.	2nd day of disease	Sudden twitching of rt. face and arm; loss of speech, paralysis of rt. arm and face soon afterwards		Complete recovery in 8 hours
Bonaba, J., and Leunda, J. J.	Arch. latino-amér. de Péd. 1925, 19; no. 10 (Abst. Zntrlbl. f. Kinderh., 1925–26, 19; 354)	F.	13 yrs.	20th day of disease	Very ill with prolonged fever, convulsions followed by right hemiplegia with aphasia		Gradual improvenent

TABLE III—*Continued*

AUTHOR	REFERENCE	SEX	AGE	TIME OF ONSET	CLINICAL PICTURE	C. S. F.	RESULT
Ott, L.	Philadelphia Med. Times, 1884, 14; 534	M.	2 yrs. 4 mos.	10th day of disease	*Mumps;* measles, focal convulsions of rt. side; soon rt. hemiplegia, loss of speech, choreic movements on left		Residual hemiplegia and defective speech
Rilliet et Barthez	"Traité des mal. d. enfants," t. 3, p. 280 (cit. by Bayle)	F.	1 yr.	6 days *before* eruption	Violent convulsions on the left then on rt. side; next day fever, rt. hemiplegia, complete; later eruption		Recovery in 5 days
Bayle Case 11	"Des paralysies conséc. à l'enf. mobilleuse," Thèse de Paris, 1886	F.	8 yrs.	5th day of convalescence	Sudden delirium and fever; next day paralysis of left arm and leg, somnolence, loss of sensibility		Recovery in 3 days
Marie, P.	(Cit. by Denaire "Des. paralysies dans rougeole." Thèse de Lyon, 1888)	F.	6 yrs.	Month later	Convulsions on left, paralysis of left arm and leg; athetosis, mental defect after 9 yrs.		Athetosis and mental defect
Schwartz, A.	Deutsch. Arch. f. klin. Med., 1877, 20; 615	F.	3 yrs.	18th day of disease	Several convulsions at height of fever; 18th day, when apparently convalescent, sudden loss speech and palsy of right arm		Complete recovery
Heubner, O.	Lehrb. der Kinderhk., 1911, Bd. 2; 119	F.	2½ yrs.	6th day of disease	Measles; *tonsillectomy;* on 4th day, stupor, fever, convulsions, rt. hemiplegia and aphasia		After 2 mos. palsy was better and speech was improved
Ford, F. R. Case 11		M.	1 yr. 9 mos.	7th day of disease	Convulsions, rt. hemiplegia, loss of speech, loss of reflexes, apathy		Residual hemiplegia

The child had several focal convulsions on the right side for three days after admission, but no more after then. On the second day of admission the tendon reflexes were present everywhere, but more active in the right arm and leg than on the left. The optic discs were considered slightly hazy.

Ten days after admission the child was definitely improved and could sit up. The weakness of the right arm and leg was less evident, and all the reflexes were now active. After one month the child was discharged apparently well except for a slight weakness of the right arm and leg.

CEREBELLAR SYNDROMES

A very interesting sequel of measles is acute ataxia of cerebellar type. Measles, indeed, is the cause of a fairly large percentage of the acute ataxias of childhood. Thus, Griffith (*Amer. J. Med. Sc.*, 1921, **161,** 781) found that 8 out of 31 cases of acute cerebellar ataxia in childhood that he was able to collect had followed measles. A purely cerebellar syndrome is unusual and there is generally evidence of more than one lesion. Batten (*Brain*, 1905, **28,** 484) concludes that the lesion responsible for the ataxia may be in the cerebellum or in the cerebellar connections in the brain-stem. The ataxia is usually generalized, but may be local. A typical "intention tremor" may be present. There is also loss of muscle tone, slow or scanning speech, nystagmus, loss of equilibrium and head tremor. In most instances the cerebellar symptoms are masked by unconsciousness at the onset, and become evident only when revealed by the child's increasing activity during convalescence. In Skoog's case the ataxia developed gradually without other nervous symptoms. Recovery was incomplete in 12 of the 14 cases included in Table IV, although there is a tendency to gradual improvement for several years. Mental reduction is mentioned in 2 cases and epilepsy followed in one. This condition must be differentiated from cerebellar neoplasm, abscess and tubercle. Epidemic encephalitis may cause a similar picture. Friedreich's ataxia may be noticed for the first time after measles and be recognized only after the progressive course becomes evident.

Case 12 (Ped. 28523). Child of 3 years developed convulsions during course of measles. During convalescence gross ataxia of all extremities and spasticity of left arm and leg. Gradual improvement.

D. E., white girl of 3 years and 2 months, was quite healthy until she developed measles at 2 years and 6 months. There were several convulsions at the onset.

TABLE IV

Cerebellar syndromes

AUTHOR	REFERENCE	SEX	AGE	TIME OF ONSET	CLINICAL PICTURE	C. S. F.	RESULT
Marsh, N. P.	Brit. J. Child. Dis., 1910, 7; 241	M.	6 yrs.	4th day of disease	Vomiting, weakness of limbs, coma; later, int. squint, general ataxia, loss of reflexes, incontinence, anesthesia		After year, mentally normal, general ataxia, cannot walk
Guthrie, L.	Brain, 1905, 28; 363	F.	7 yrs.	At height of fever	Vomiting, stupor, squint, reflexes +, rigidity; later general ataxia, tremor, drawling speech, clonus		After 16 mos. still ataxic, cannot walk, reflexes + drawling speech
Batten, F. D.	Brain, 1905, 28; 484	M.	3½ yrs.	During convalescence	Vomiting, convulsions, coma; later general ataxia, slow speech, active reflexes, mental changes		After 16 mos. almost well; sl. ataxia
Schepers,	Berl. klin. Wchnschr., 1872, 9; 517	F.	8 yrs.	4th day of disease	Unconscious; later, loss of speech, ataxia of legs, loss of memory; still later speech defect and ataxia		Recovery apparently in several months
Griffith, J. P.	Amer. J. Dis. Child., 1920, 20; 82	F.	6 yrs.	Following measles	Squint, ataxic gait, speech defective, mental apathy, nystagmus		After 16 mos. alternating squint, mental defect, active knee-jerks, nystagmus
Pitt, G. N. Case 3	*Loc. cit.*	F.	5 yrs. 9 mos.	6th day of disease	Delirium, coma, rapid recovery except for ataxia of right hand		Persistent ataxia of right hand
Skoog, A. L. Case 1	Jour. Am. Med. Assn., 1920, 74; 1697	F.	4 yrs.	12th day of disease	Irritability, ataxia in all limbs, ataxic gait, sl. nystagmus, onset gradual		Recovery complete in 7 weeks
Case 2		F.	4 yrs.	During measles	Measles, *bronchopneumonia, otitis*, extreme ataxia, loss of speech, mental change, restlessness	No cells	After year much improvement, loss of speech, petit mal, ataxic but can walk

Fairbanks, A. W.	Arch. Pediat., 1907, 24; 770	F.	4½ yrs.	2 weeks after measles	Prolonged screaming, mental confusion, ataxic gait, and ataxia of right hand, right Babinski		After 7 mos. ataxia right arm, ataxic gait, no Babinski
Guthrie, L., and Smith, J. A.	*Loc. cit.*	F.	6 yrs.	3rd day of disease	Vomiting, convulsions, squint. loss of speech, general ataxia, rigidity, reflexes increased, anesthesia		After 8 mos. scanning speech, general ataxia, cerebellar gait, reflexes +, clonus
Horwitt, S.	*Loc. cit.*	M.	?	Noted on attempt to walk 3 weeks later	Onset indefinite, cerebellar ataxia, nystagmus, ataxic gait		After 3 mos. partial recovery
Clapton, E.	Tr. Path. Soc. London, 1871, 22; 20	F.	4 yrs.	Following measles	No history of onset; mental defect, ataxia of arms and legs		Still ataxic and mentally defective after 30 yrs.
Fox. T. C.	Lancet, 1887, i; 771	F.	4½ yrs.	7th day of disease	Squint, irritability, slow speech, general ataxia, nystagmus, head tremor		Almost complete recovery in 6 mos.
Ford, F. R. Case 12		F.	3 yrs.	During convalescence	Convulsions, general rigidity; later severe ataxia of cerebellar type, spastic legs		Still very ataxic and cannot walk after 8 mos.

During convalescence the patient's legs were noted to be "drawn up" and stiff; the left leg seemed to be affected more than the right. After several weeks there seemed to be almost complete recovery, but on attempting to walk it was found that the child was extremely ataxic. The gait gradually improved, but the child still required support. Sphincter control was never lost. There were no more convulsions, and the mental condition was normal.

Examination, 8 months after the onset, showed a well developed and well nourished child of three years, cranial nerves normal, marked ataxia of cerebellar type in all extremities. The child could walk by pushing a chair in front of herself, but could not stand without support. Movements of arms were also ataxic. Strength was slightly diminished in the left arm and leg and there was some spasticity on that side. Tendon reflexes were more active in the left arm and leg than on the right side, and there was a bilateral extensor response. Spinal fluid showed 3 cells. Globulin o. Wassermann negative. Gold curve 00000000. Skin tuberculin test negative. Medical examination negative. Blood Wassermann negative. Urine negative.

Gradual improvement occurred, but complete recovery did not seem probable.

PARAPLEGIAS AND SPINAL CORD SYNDROMES

We may distinguish two subgroups in this division; in one there is evidence of general involvement of the nervous system with stupor and convulsions, but the chief incidence of the disease is on the spinal cord; in the other the spinal cord alone is affected, the mind is clear and the picture is that of an acute ascending paralysis. This is almost always flaccid at first, with loss of reflexes, but later the reflexes are usually increased and the gait spastic, although there may be atrophy of certain groups of muscles. Loss of sensibility is present in most cases in the early stages, but this generally passes off during convalescence and is always less severe than the motor symptoms. The sphincters are frequently involved. There are 33 patients included in this group, of whom 6 died of respiratory paralysis, 15 recovered completely, and 10 showed various types of motor weakness, including muscular atrophy in 3. Two were not followed. Polyneuritis and poliomyelitis are usually ruled out by the appearance of spasticity in convalescence, but the differential diagnosis may be difficult if the paralysis is flaccid, as it was in the cases of Holmes Coote and in the eleventh case of Boenheim. We have not observed cases of this type in the Harriet Lane Home so we may give as examples abstracts of two cases from the literature: one by Bergenfeldt and one by Box.

Bergenfeldt's case 2. Boy of 6 years on 5th day of measles retention of urine, later paralysis of legs, reflexes increased, bilateral Babinski sign, ankle clonus, Kernig's sign, stiffness of neck, stupor. C. S. F. negative. Death on 8th day of disease.

A boy of 6 years was taken ill with headache and cold in the head. On the 2nd day the eruption of measles appeared. Six other children in the family were ill with measles at the same time. The measles ran a moderate course until the 5th day when the child complained of pain in the back and could not pass his urine. When brought to the hospital on the 6th day, he was stuporous. T. 37.5°C. P. 108. Head retracted. Stiffness of neck. Kernig positive at 60°. Legs drawn up on abdomen. Definite rigidity at all joints. Apparent paralysis of legs. Arms moved freely. Knee and ankle jerks feeble. Babinski negative. No definite abdominal reflexes. Pupils normal and cranial nerves intact. Bladder distended. C. S. F. Pressure 160 mm. Pandy negative. Cells-3–4, all lymphocytes. On the 8th day, T. 40.8°C. Legs flaccid. Knee and ankle jerks increased. Bilateral ankle clonus and Babinski reflex. Arms rigid. Death.

Case of Box. Girl of 14 years developed acute ascending paralysis on the third day of measles. On 5th day abdominals and intercostals were weak and legs were paralyzed. Anesthesia to T6. Loss of reflexes. Sensorium clear. Rapid improvement. After 7 months, spastic legs with increased reflexes.

Girl of 14 years developed measles which ran a moderate course for 3 days. The temperature then rose to 103°F. That night the child attempted to get out of bed and found that she could not stand. There was retention of urine. On the 4th day there was paralysis of all the muscles of the legs except the hamstrings and the flexors and extensors of the great toes. Abdominal muscles were somewhat weak. Tactile sensibility was not demonstrably altered, but the sense of pain was lost over the legs. The knee jerks and abdominal reflexes were absent. The bladder was distended. Temperature 102°F. On the 5th day the recti abdominis and all the muscles of the legs were paralyzed completely. The sensorium was clear. On the 6th day there was slight return of power in the extensors of the left foot, but the intercostals were becoming weak. The patient thought the left arm was slightly affected. There was loss of pain and temperature sensibility up to the level of the 6th dorsal segment. No weakness of the arms was demonstrable. The cranial nerves were negative. The optic fundi showed no change. The right knee jerk was still absent, but the left was feebly present. The abdominals could not be elicited. On the 7th day there was some general improvement in strength, and there was some movement in the ankles. On the 13th day all movements were present although feeble, and no loss of sensibility could be made out. Sphincter control was regained. The plantar response was extensor on the 15th day and the knee jerks were increased. After 7 months recovery was complete except for increased knee jerks, doubtful Babinski reflexes and slight urgency of urination. The patient walked well but tired quickly.

TABLE V

Paraplegias and spinal cord syndromes

AUTHOR	REFERENCE	SEX	AGE	TIME OF ONSET	CLINICAL PICTURE	C. S. F.	RESULT
Eliott, E. F.	Lancet, 1900, 1; 533	F.	18 yrs.	4th day of disease	Tonic convulsions, coma, pupils sluggish, loss of reflexes, paralysis of legs, paresis of arms, incontinence		Recovery in 4 months
Bergenfeldt, E. Case 1	Acta Medica Scandinavica, 1924–25, 61; 281	M.	14 yrs.	5th day of disease	Apathy, weakness of legs, stiff neck, incontinence, loss of reflexes, no sensory loss, Kernig sign positive	Cells 0; glob. +; pressure 290 mm.	Recovery in month
Case 2		M.	6 yrs.	5th day of disease	Stupor, rigidity, paralysis of legs, Babinskis, reflexes increased, stiff neck, Kernig sign, incontinence	Cells 4; glob. 0; pressure 160 mm.	Death on 8th day. Autopsy
Case 3		F.	6 yrs.	5th day of disease	Paralysis of legs, retention of urine, loss of reflexes, no clouding of consciousness	Cells 1; glob. 0	Not followed but improving when discharged
Bassette, I. Case 2	J. Nerv. and Ment. Dis., 1892, 17; 461	F.	3 yrs.	3rd day of disease	Loss of speech, paralysis of arms, legs, incontinence, weakness of neck, some diminution of sensibility		Still weak after 3 months
Case 4		F.	4 yrs.	"While still in bed"	Very ill, convergent squint, weakness in arms and legs, loss of knee-jerks		Steady improvement in 2 months of observation
Williams, D.	Med.-Chirurg. Trs., London, 1893, 77; 57	F.	3 yrs. 8 mos.	3rd day of disease	Stupor, paresis of arms, paralysis of legs, incontinence, anesthesia of legs, active reflexes; later spastic gait		After 7 yrs. spastic gait, ataxia of hands, mental defect
Pitt, G. N.	*Loc. cit.*	M.	12 yrs.	3rd day of disease	Drowsy, retention of urine, paresis of arms, and legs, resp. weak, loss of all reflexes, dilated pupils		Death on 6th day

Boenheim, C. Case 10	*Loc. cit.*, 1925	?	?	"At onset of eruption"	General flaccid paralysis		Recovery when eruption faded
Case 11		F.	2½ yrs.	"At onset of disease"	Atrophic flaccid paralysis of left leg involving esp. muscles supplied by N. peroneus		Residual club-foot
Box, C. R.	Lancet, 1921, i; 222	F.	14 yrs.	3rd day of disease	Paralysis of legs and recti abd., retention of urine, anesthesia to T6, loss of reflexes, later increased reflexes		After 7 mos. k. k. +, Babinski's (?), urgency of urination, gait normal
D'Espine, Ad.	Presse méd., 1920, 28; p. 617	M.	8 yrs.	5th day of disease	Flaccid paralysis of legs, loss of reflexes, anesthesia to T9, retention of urine		No report
Barlow, T.	Med.-Chirurg. Trs., 1887, 70, p. 77	M.	23 yrs.	3rd day of eruption	Drowsy, retention of urine, paralysis of legs and arms and later of resp. muscles, loss of reflexes		Death. Autopsy
Lucas, J.	London Med. Jour., 1790, p. 325 (cit. by Barlow)	F.	23 yrs.	8th day of illness	Paralysis of legs, retention of urine		Complete recovery in 12 days
Liegard, M.	Gaz. d. hôp., 1859 (*cit. by Barlow*)	M.	2 yrs.	At beginning of convalescence	Ascending paralysis of limbs, and bulb, loss of sensation in legs, sphincters intact		Recovery complete in 3 weeks
Cit. by Williams	Repts. Pendlebury Gen. Hosp. for Ch., Manchester, 1883	F.	4 yrs.	Noted at beginning of convalescence	Weakness of legs, reflexes increased		Gait still spastic after 6 months
Perret	Clin. méd. de l'Hôtel-Dieu de Lyon, Paris, 1887 (cit. by Denaire)	M.	man	Noted at beginning of convalescence	Paralysis of legs, retention of urine, no sensory loss, reflexes normal		Rapid recovery
Coote, Holmes Case 1	Lancet, 1864, i; 665	F.	2 yrs.	Noted in convalescence	After 4 yrs. showed atrophy of rt. leg and thigh, equinus of rt. foot, and slight shortening of rt. leg		No change
Case 2		M.	3 yrs.	Noted in convalescence	Atrophy of left leg and talipes equinus of left foot after 2 yrs.		No change

TABLE V—*Continued*

AUTHOR	REFERENCE	SEX	AGE	TIME OF ONSET	CLINICAL PICTURE	C. S. F.	RESULT
Brückner, M.	Jahrb. f. Kinderh., 1902, 56; 724	M.	4½ yrs.	13th day of eruption	Pain in back, flaccid paralysis of legs loss of k. k., sensory loss in legs, severe constipation		Recovery in 6 weeks
		M.	8½ yrs.	Secondary rise in temp. on 11th day. Paralysis noted on convalescence	Indefinite onset, paralysis of legs and sensory loss below navel, noted in convalescence; rt. ankle clonus, k. k. increased, dysuria		Could walk in 4 weeks. Complete recovery in end
Schreiber, G. Case 1	Bull. Soc. péd. de Paris, 1925, 23; 337	?	6 yrs.	8th day of disease, one day after fever fell	Temp. normal 2 days, then rose to 40°C. Paralysis of legs, retention of urine, loss of reflexes		Complete recovery in 40 days
Case 2		M.	8 yrs.	7th day of disease, one day after fever fell	Temp. 37.5° for 24 hrs. then rose to 40.5° stiff neck, stupor, paralysis of legs, retention of urine, loss of reflexes, no R. D.		Retention of urine after month
Lop, P. A. Case 1	Gaz. d. hôp., 1893, 66; 1015	M.	3 yrs.	12th day after eruption	Weakness and then paralysis of legs, pain in legs, no loss of sensibility, retention of urine, loss of k. k.		Recovery complete in 30 days from onset
Case 2		F.	3 yrs.	12th day of eruption	Rapid paraplegia with retention of urine, constipation, some loss of sensibility		Recovery in 30 days
Ortholan (cit. by Brückner)	"De quelques formes de paralysie morvilleuse" Thêse de Bordaux, 1894	F.	3 yrs.	19th day of disease	Measles, *pneumonia*, weakness of arms, and body, flaccid paralysis of legs, no sphincter trouble, no sensory loss		Recovery in 4 weeks
v. Starck	Jahrb. f. Kinderh., 1898, 47; 219	F.	8 yrs.	During stage of eruption	High fever, pain in back, sl. drowsiness, weakness of legs and muscle cramps, increased reflexes, retention of urine		Recovery in few weeks

Petren, K.	"Uber das Auftreten von Lähmung nach Masern" 1897, Lund. (Abst. Schmidt's Jahrb. 1898, 257; 237)	M.	12 yrs.	After measles	Paralysis of legs and weakness of muscles of arms and trunk; after 2 mos. spastic legs, reflexes increased		Some improvement in 2 yrs.
Ellison, W. A.	Lancet, 1896, ii; 1077	M.	14 yrs.	5th day of disease	Vomiting, diarrhea, ascending paralysis and anesthesia, loss of reflexes, loss of sphincter control, resp. death		Death in 7 days
Bayle, L. Case 13	*Loc. cit.*	M.	24 yrs.	2nd day of convalescence, 12th day of disease	Sudden paralysis of legs, loss of sphincter control, anesthesia, loss of reflexes, pain in back, decubitus		Death on 31st day. Congestion of cord. Microscopic neg.
Ferry, J.	Arch. de méd. et de pharm. milit. Juin 1886 (cit. by Denaire)	M.	20 yrs.	9th day of disease, 2nd day of convalescence	Headaches, retention of urine, paralysis of legs, no sensory loss, reflexes normal, improvement in 3 days		Recovery in 18 days from onset of illness
Bouchut	Gaz. des hôp., 1870. (cit. by Denaire)	F.	4 yrs.	Month after onset	Sudden weakness of legs without constitutional symptoms		Recovery in 25 days
Bergeron	Gaz. des hôp., 1868 (cit. by Denaire)	?	3 yrs.	42 days later	Weakness of arms and legs, paralysis of respiration, bulbar palsy		Death. Congestion of cord. Microscopic neg.
D'Celsnitz, et Cornil, L.	Bull. Soc. péd. de Paris, 1919, 17; 28	M.	5 yrs.	During attack	Pain in legs, weakness and atrophy of arms, spastic legs with increased reflexes, brief retention of urine, no sensory loss		After 6 mos. legs still spastic

OTHER NERVOUS COMPLICATIONS OF MEASLES

Mental disturbances are not uncommon, and initial delirium is present in almost all cases in which the nervous system is seriously affected except in some cases of acute ascending myelitis and of some hemiplegias in which the onset is apoplectic. This early delirium is usually associated with high fever and is not more frequent or more severe than in any other acute infectious disease. During convalescence transient mental disturbances are common and prolonged toxic psychoses may occur. In 1899, Sotow (*Jahr. f. Kinderh.*, 1899, **50,** 1) was able to collect 11 case reports of this nature. He mentions two cases reported by Henoch, in one of which there were brief episodes of excitement beginning at the end of the seventh week and in the other, that of a seven-year-old boy, a state of excitement and fear appeared on the fourteenth day. Chatelani described a case with both manic and depressive features in a girl of five years. Kraepelin mentioned delirium with auditory and visual hallucinations in a girl of 13 and excitement with delirium in a boy of 6 years. The boy's sister, who was 8 years old, was ill at the same time and was depressed. Finkelstein's patient, a boy of thirteen years, showed delirium and terrifying hallucinations. In the case reported by Hiergrifow the patient, a girl of 13 years, developed hallucinations and excitement during the incubation period. Kowalewski observed depression and delirium in a boy of eleven years. Demme also described a case of mental disturbance following measles. Sotow's own case was that of a boy of four years who developed frequent convulsions during the incubation period. After two weeks these returned and continued at very frequent intervals during the four months he was under observation. There was much clouding of consciousness with hallucinations and excitement.

In a recent review of the subject, Boenheim (*loc. cit.*, 1925) mentions reports of cases of delirium and hallucinosis by Adler and by Heubner, of states of excitement by Fleischman, and of depression by Emminghaus. Szorady described a mental disturbance developing during the incubation period which closely resembled hysteria. Boenheim also refers to articles by Siemerling, Bonhöffer, Griesinger, Müller and Kraepelin in which the whole subject of psychoses following

infectious diseases is discussed. More recently Boenheim (*loc. cit.*, 1927, case 4) has published a case of a girl of 7 years who developed delirium with alternating excitement and somnolence after measles. In general the prognosis seems to be good. In the eleven cases collected by Sotow, nine of the patients recovered, one died, and his own patient whose case was only doubtfully connected with measles showed no improvement after 4 months. These are all toxic-delirious states with more or less affective coloring. The rôle of the patient's personality is a very large one and there is nothing specific in the effect of the measles toxin.

The commonest mental residuum of measles is a reduction in intelligence. Beach (*Brit. Med. J.*, 1895, ii, 707) states that out of 2000 idiots confined in British institutions about eleven owe their conditions to measles. He gives no account of individual cases. In the 125 cases abstracted in this article mental defect was noted in 22. Change in personality, irritability, emotional lability, destructiveness and asocial behavior, such as are found so frequently after epidemic encephalitis, are less common but are mentioned. Narcoleptic attacks followed in Lust's case 4.

General convulsions alone at the onset are perhaps less frequent in association with measles than with most other acute infectious diseases of infancy. In all but a few cases there are signs of latent tetany. Indeed, Boenheim observed convulsions 180 times in 5,940 cases of measles, but in all but eleven cases there were other evidences of spasmophilia. In the eleven cases Boenheim believed that the measles intoxication was more directly to blame for the convulsions. In the vast majority of instances the convulsions do not continue after recovery from the acute stage, but in 6 of the cases abstracted in this article epilepsy followed. In Boenheim's case 3, (*loc. cit.*, 1927) that of a girl of seven years, convulsions ocurred when the temperature fell and subsequently recurred at frequent intervals. There were no other nervous symptoms, but later there was precocious menstruation, early development of sexual characteristics, and adiposity.

True meningitis is a very doubtful complication of measles, although it has been described repeatedly. The cases of so-called serous meningitis or meningism have been described in the first section. The spinal fluid usually shows very little change in these cases, but in

cases such as those of Todesco, Laroche and Quioc and of Lowenberg, the spinal fluid was turbid with polymorphonuclear leucocytes. In the case of Lemierre, Michaux and Limasset the spinal fluid was also turbid, but contained 80 per cent of large mononuclear cells and only 20 per cent of lymphocytes. There was evidence of pneumonia in the latter case, but the other cases were uncomplicated by secondary infections as far as could be determined. Several cases described as measles meningitis have been omitted because the meningitis was probably due to otitis, mastoiditis, sinus infection, or pneumonia. In the cases mentioned above cultures of the spinal fluid were made and no growth was obtained. We may conclude that in general a cloudy spinal fluid is very suspicious of secondary infection although it seems probable that it may be due to the measles virus alone in rare instances.

Optic neuritis may follow all the acute infections and measles is no exception to this rule. De Schweinitz (*Diseases of the Eye*, 1924) mentions several instances and refers to observations by Uthoff and others. Retinal thromboses may occur. Boenheim (*loc. cit.*) mentions a case reported by Nagel in which cortical blindness followed measles. Horwitt described "choked discs" in his case, and in Brock's case 9 and Lust's case 2 optic neuritis was noted. These lesions almost always clear up and leave no visual defect. Morton (*Univ. of Penn. Med. Mag.*, 1897, **9**, 740) has described an undoubted case of polyneuritis which followed measles, although he admits that it is possible there may have been a complicating diphtheria. Henoch (*loc. cit.*, p. 703) has also published a similar case complicated by pneumonia in which the symptoms indicated polyneuritis. However, it seems clear that polyneuritis is rarely, or never, a true complication of measles and most cases so termed were complicated by unrecognized diphtheria or were in reality "myelitis." Dreisch (*Münch. Med. Wchnschr.*, 1898, **45**, Nr. 1, 627) has published 2 cases of loss of power of accommodation and one of ophthalmoplegia which developed several weeks after an illness supposed to be measles. None of these patients were seen in the acute stage of the illness.

PATHOLOGICAL ANATOMY

In 1868 Bergeron published a case of acute ascending paralysis following measles in which the examination of the nervous system was made by Ranvier. Grossly, the spinal cord was much congested but no lesions could be demonstrated by the histological technique of that day. Similar results were reported by Bayle in 1886. He found extreme congestion in the lumbar enlargement but no evidence of inflammation or microscopical abnormalities. Very different were the findings in the case reported by Sir Thomas Barlow before the Medico-Chirurgical Society of London (1887). His description, somewhat abbreviated, runs as follows:

"There was much venous distention of the meninges but no lymph. The gray matter of the convolutions was darker than natural. The brain substance was unduly soft. The ependyma of the lateral ventricles was easily detached. In the spinal canal there was much venous engorgement. On slitting up the membrane no lymph was found. The whole of the cervical enlargement was swollen and softer than natural. At a situation corresponding to the 5th dorsal vertebra, the whole of the cord was diffluent, and could not be removed intact. The lumbar enlargement, although it felt tolerably firm externally, was found on section to present some softening in the lateral and posterior columns and the gray cornua seemed to have been the seat of small haemorrhages, being discolored and in some places tunnelled out and the substance very pulpy." Dr. Penrose performed the microscopical examination. His report reads as follows:

"Examination of the cord shows that the changes are entirely vascular in character, that they are universally distributed, but of greater intensity in some regions than others. There is great engorgement of the vessels, most of the veins being many times their normal calibre and crammed with corpuscles. Many vessels are surrounded by a zone of coagulated exudation and beyond this for a considerable distance the tissues are infiltrated with leucocytes, giving the appearance in transverse sections of a series of concentric rings. Beyond extensive diapedesis there is further evidence of the severity of the congestion, shown by rupture of vessels with subsequent slight interstitial haemorrhage. The portion of the cord which had suffered most was the upper dorsal region which was so soft that it was impossible to make sections of it. Throughout, the anterior cornua have been most affected, as it is chiefly in them that the haemorrhages are to be found, but vascular changes in other parts are nearly as great, and moreover, are not confined to the cord, for in both anterior and posterior nerve roots the vessels are much engorged. No changes have been found in the nerve cells, fibers, or supporting tissues of the cord, and staining by Gram's and ordinary methods has failed to demonstrate the presence of microorganisms. In the medulla oblongata, the

TABLE VI

Spinal fluid changes

AUTHOR	CASE	CLINICAL PICTURE	APPEARANCE	CELLS	GLOBULIN	SUGAR	PRESSURE	CULTURE	SMEAR
Neal and Applebaum, *loc. cit.*	1	Meningism.	Clear	Large increase in monos	++	+ 3	Moderate increase	0	0
	2	Meningism.	Clear	Sl. increase in monos	+	+ 3	Increased	0	0
	3	Hemiplegia	Bloody with web	R.B.C.	+ 1	+ 3		0	0
	4a	Hemiplegia	Clear	3 monos	+	57 mgm.		0	0
	4b	Hemiplegia	Clear	12 monos	+	+ 3		0	0
	4c	Hemiplegia	Clear	8 monos	±	+ 3		0	0
	5	Multiple focal signs	Clear	3 monos		+ 3		0	0
	6	Multiple focal signs	Clear	15 monos	+	84 mgm.		0	0
	7	Not given	Clear	Normal	+	+ 3		0	0
	8	Not given	Clear	87 monos	+ 1	+ 3		0	0
	9	Not given	Clear	Sl. increase in monos	±	+ 3		0	0
	10	Not given	Clear with web	Large increase in monos	+ 1	+ 3		0	0
	11	Not given	Normal	Normal	±	+ 3		0	0
	12	Not given	Bloody	R.B.C.	±	+ 3		0	0
Lemierre, Michaux, Limasset.		Meningism.	Turbid	Large monos 80 per cent Lymphocytes 20 per cent	+			0	
Todesco, J.		Meningism.	Sl. turbid	All polymorphs	+			0	0

Boenheim, C., 1927	1	Meningism.	Clear	4 cells	+		Increased		
	2	Meningism.	Clear	4 cells	+				
	4	Delirium	Clear	3 cells	0				
Boenheim, C., 1925	2	Meningism.	Clear	Normal	0		Increased		
	7	Multiple focal signs	Clear	Normal	+		400 mm.		
	8	Delirium and manic state	Clear	4 cells	+		90 mm.		
	9	Hemiplegia	Clear	10 cells	0		Increased		
Brock, J.	9	Multiple focal signs	Clear, no film	120 cells	++++		170 mm.	0	0
	10	Multiple focal signs	Clear	170 cells	+++		290 mm.	0	0
Mosse, K.	1	Multiple focal signs	Clear	Not increased	+	+ 0	Increased		
	2	Multiple focal signs	Clear	1 cell	+	0	Increased		
Laroche, G. Quioc.		Meningism.	Sl. cloudy	195 lymphos 13 polys	Protein, 75 mgm.	55 mgm.		0	0
Skoog, A. L.	2	Cerebellar ataxia	Clear	No increase					0
Redlich, F.		Multiple focal signs	Clear	No increase	+		Increased		
Horwitt, S.		Multiple focal signs	Clear	Large increase 95 per cent monos	+			0	
Lowenburg, Shaller		Multiple focal signs	Sl. cloudy, sl. film	Large increase 80 per cent polys	+ 4	++		0	0
McLendon		Multiple focal signs	Clear	12 polys 4 lymphos	+				

TABLE VI—*Continued.*

AUTHOR	CASE	CLINICAL PICTURE	APPEARANCE	CELLS	GLOBULIN	SUGAR	PRESSURE	CULTURE	SMEAR
Bergenfeldt	1	Myelitis	Clear	No increase	+		290 mm.	0	0
	2	Myelitis	Clear	3–4 lymphos	0		160 mm.	0	0
Lust, F., 1927	1	Multiple focal signs	Clear	18 monos	Protein 0.04 per cent	0	160 mm.	0	0
	2	Multiple focal signs	Clear	No increase	Protein 0.02 per cent		120 mm.	0	0
	3	Hemiplegia	Clear	No increase	Pandy 0		300 mm.		
	4	Multiple focal signs	Clear	No increase	Pandy 0		Normal		
	In 3 cases of measles without nervous symptoms there was no increase in cells or protein, but the pressure was 300 mm. in one case on two occasions. The sugar was always low, readings 0.0428, 0.0375, 0.0357, 0.0285 and 0.0198 per cent being obtained.								
Ambrus, Jahrb. f. Kinderh., 1924, 106; 351	In the beginning of the prodromal stage of measles the pressure was often found to be increased, and precipitation in the last 4 or 5 tubes in the colloidal gold chloride test, as noted in some cases.								

changes are very similar to those in the cord, except that no haemorrhages have been seen. The stress seems to have fallen chiefly on the hypoglossal and vagus nuclei, and from the sections which have been made would appear to have been greater on the left than the right side."

Barlow's case was clinically very similar to other cases of spinal paralysis following measles, but the pathological findings are so atypical that we are justified in questioning the diagnosis or at least suspecting some unrecognised complication.

In Bergenfeldt's case 2, the microscopical examination was made by Sjövall. Grossly, there were no changes in the brain or cord.

"The brain and meninges showed no changes. Especial attention was devoted to the brain-stem which showed no perivascular infiltration or degeneration of the nervous tissue such as are found in lethargic encephalitis.

"The spinal cord and spinal meninges showed changes of very definite character which were fully brought out by the fat-stains. These changes were chiefly in the gray matter of the cord and are prominent in every segment of the cord without any special predilection for the enterior horns. Quantitatively they are more severe in the lower part of the cord and in the region of the central canal. The changes consist of an extremely fine destruction of the nervous substance which is seen in the form of little fat granules which lie free in the tissues or enclosed in cells with round nuclei and clear cytoplasm. Most of these fat granules are contained in phagocytes. Such cells containing fine fat granules are found in numerous clusters about the central canal. They are somewhat elongated apparently from pressure of the surrounding tissues. They are definitely wandering phagocytes. Similar cells are found near the motor cells of the anterior horns but usually in small numbers. The motor cells are not diminished and nowhere show definite degeneration or neuronophagia. Besides these changes in the nervous tissues, fat-containing phagocytes are found in the adventitia of the blood vessels. In these cells the fat granules are coarse. Besides these phagocytes, there are to be seen in the same location cells with round nuclei and indistinct cytoplasm which do not contain fat. One often sees a group of these cells surrounding one or two fat-granule cells. These cell collections are found extending along the vessel wall for some distance, and it is characteristic that the vessel wall between these spots shows not the least infiltration. This picture indicates very definitely that the cell infiltration is not primary in the disease, that it is not primarily an inflammatory process, but it is merely the migration of phagocytes which are conveying fatty debris from the marrow to the vessel wall. The fat-laden phagocytes, apparently because of an absorbed toxic substance, call forth a round-cell reaction. The meninges show no other changes than a slight cell infiltration around isolated vessels, of the same nature as those described above. The nerve roots and trunks show no lesions."

Mosse was fortunate enough to secure autopsies in both of his cases. The microscopical examinations were made by Guillery in case 1, and by Creutzfeld in case 2. The brain in both cases showed marked congestion and oedema, but no other gross lesions. Guillery states briefly that in sections of the cortex, cerebral white matter, central gray matter, cerebral peduncles, pons, cerebellar cortex and medulla oblongata there was everywhere marked oedema, especially under the ependyma, unusually fine lipoid granules in the cells of the vessel walls, and a small quantity of fine lipoid granules in the perinuclear glial cytoplasm.

Creutzfeld's description is more detailed:

"Blocks were taken from the cortex and brain stem. Nowhere were any changes of inflammatory nature found such as perivascular lymphocytic infiltration, but in the deeper layers of the cortex and white matter the endothelial cells were hyperplastic and the vessel walls were distended by macrophages and Gitter cells. A moderate round-cell infiltration was observed around just one vessel, but this observation could not be duplicated elsewhere. The perivascular glia, especially the astrocytes, appeared to be increased. In the white matter of the convolutions the little hyperchromatic ovoid nuclei were increased; and some typical glial phagocytes were seen. In the Herxheimer fat-stain preparations most of the vessel walls in the white matter were seen to be loaded with fat-granule cells and not very sharply circumscribed. There were also foci of fat-granule cells in the nervous tissue so one is led to believe that the foci of degeneration began in the region of the blood vessels. There were outspoken fatty degenerations in the striae medullares, in the caudate nucleus and putamen, and fatty deposits were also to be found in the internal capsule and cerebral peduncles. With the myelin stain one found areas in which the myelin sheath stained poorly and showed various swellings and fragmentation. These areas correspond to the regions of fatty infiltration shown by the Herxheimer stain. With the Bielschowski method degenerative changes were found in the nerve fibers. One saw destruction of the nucleus; crumbling, swelling, twisting and irregular staining of the fibers. In many swollen fibers the fibrils were crowded to the margin and the center stained poorly. In the glial fiber preparations the glial fibers were apparently increased in the regions about the vessels. This was not a true gliosis, although the thickness of the fiber network and the caliber of the single glial fibers exceeded the normal. The glia in the stratum zonale and the subependymal glia showed definite marginal feltwork. As far as one could determine the condition of the glia cells in material treated with Orth's solution, there was slight swelling of the nucleus and cytoplasm. The Nissl bodies were not demonstrable, the cell yolk was pale, stained metachromatically and studded with small granules. The processes were only poorly stained and visible for a short distance. The nuclear membrane was stained a deep blue

and showed up clearly, appearing broader than normal. One could make out with difficulty the nuclear aggregation and numerous chromatin fragments in the framework of the nucleus. The nucleolus was remarkably pale. The polar body was still recognizable and colored deep blue. The stellite cells were apparently increased about many nerve cells and their cytoplasm was distinctly visible, their nuclei rich in chromatin. Here and there one found their nuclei pyknotic and amoeboid changes in the cytoplasm, although there were no definitely amoeboid cells. One saw an accumulation of fine fatty granules in some of the nerve cells in the region of the affected vessels and also some coarser granules in the glia cells of the Hortega type. In general, however, the nerve cells were free from fat, or contained at most a few granules which stained poorly with Scharlach."

Creutzfeld says in summary: "This was clearly a degenerative process which reached its greatest development in the white matter of the cerebral cortex. Nothing is against this conclusion except a moderate lymphocytic infiltration of one vessel. The degeneration of the white matter was clearly the result of vascular changes, but still did not show the circumscribed, focal lesions of multiple sclerosis. The histological picture resembled much more the so-called encephalitis congenita of Virchow. If the cortical changes did not lead to any recognizable cell loss, still it is clear that there was beginning disintegration of the nervous parenchyma from the fatty infiltration of the pyramidal cells, the marked fatty changes in the glia and cortical vessels of that region. I could not discover any hemorrhages."

In case 10 of Brock's series the histological study was made by Siegmund.

"Dura somewhat tense. Leptomeninges delicate, smooth and moist. Convolutions of normal appearance. Large vessels at the base normal. Consistence of brain somewhat soft. On the cut surface there is everywhere high grade dilatation of the smaller vessels, but nowhere hemorrhage. The white matter is soft, reddish, sharply delimited from the cortex and brain stem. There are many little yellowish-red, soft, opaque spots irregularly outlined and scattered over the white matter in the cerebellum, pons and near the margin of the cortex. Occasionally they are larger, indistinctly outlined foci. Microscopically the foci are the same everywhere. In the middle lies a dilated vessel with thin walls filled with red cells. Around this is an almost circular rarefaction of the brain tissue. The glia cells are large and rich in cytoplasm in this region. These glial changes merge very gradually into the normal tissues. In fat and myelin stained sections it is evident that in the center of these foci the myelin sheaths are completely destroyed. In their place one finds a collection of glial elements full of fatty granules, which are large in the center of the focus and fine in the periphery. Around the central vessel the fat granules lie in the adventitial cells. Also in the capillary endothelium are found lipoid waste products. The axis cylinders are apparently very little injured. In Gieson-stained material there are seen, especially in the margin of the foci, increase in glial fibers and even new formation of glial fibers. No meso-

dermal reaction. No leucocytes, or lymphocytes, or plasma cells. Nothing in the meninges except a few cells lying loose in their meshes. The whole process is characterized by a focal myelin destruction with relatively well preserved axis-cylinders, lipoid collections in the glia cells, and beginning gliosis in the margins of the foci. The vessels are definitely hyperemic."

Wohlwill (*Biol. Abt., ärztl. Ver.*, Hamburg, Sitzg. v, **1**, 111, 1927) describes the histological changes in two cases. His findings are exactly the same as those given above, except for his discovery in one case of a few scattered foci in which lymphocytes and plasma cells were found in the adventitia of the small veins.

The author has been unable to find any complete description of the so-called hemorrhagic encephalitis which sometimes follows measles. Winnicott and Gibbs state merely that such a condition was found.

Musser and Hauser (*Jour. Am. Med. Assn.*, 1928, **90**, 1267) have secured autopsies in 8 cases.

On section of the brain the striking changes noted were discrete, punctate hemorrhages . . . . and . . . . some areas of diffuse hemorrhage. A study of sections revealed lesions that were in part seen in the brain in other types of encephalitis. There was one lesion, however, that was unlike any one that we know to have been found in infectious encephalitis; namely, perivascular hemorrhages about some of the small vessels of the brain. There was no diffusion of the erythrocytes beyond this (perivascular) space. A search for injury to the endothelial lining of such vessels did not show any lesion present . . . . Other vessels of the encephalon, particularly the smaller ones, showed still another type of lesion. In these the perivascular spaces were crowded with cells of the lymphocytic variety. It is remarkable that few if any neutrophiles were observed in this type of exudate . . . . Occasionally an infiltration of round cells of the small lymphocytic type was noted, scattered diffusely through the brain substance. There were also . . . . small areas of interstitial hemorrhage. It is worthy of note that the brain cells did not show any microscopic changes (degeneration) except in the areas of hemorrhage . . . . which showed all stages of degeneration.

It is very probable that the picture which Musser describes is essentially the same as that seen by Creutzfeld and others with the addition of scattered hemorrhages due to the action of the measles toxin on the vessel wall.

If we make allowances for differences in terminology, it seems clear that all the recent histological studies have revealed exactly the same lesions, and there is general agreement among the pathologists that

the process is not to be considered an inflammation due to the localization of the virus in the brain, but that it is a toxic degeneration due to the action of some poison carried by the blood stream. The terms encephalitis and myelitis are, therefore, inapplicable. The only evidence which seems to contradict this conclusion is the definite pleocytosis which is found in the spinal fluid in most cases, and the acute inflammatory lesions which Penrose found in Barlow's case. It is possible that Penrose's histological technique did not enable him to distinguish between phagocytes and leucocytes. The persistent focal signs, such as hemiplegias, are in all probability due to vascular lesions, as the apoplectic onset suggests. Haemorrhages are not an essential part of the pathological picture.

It does not seem probable that the lesions described above are peculiar to measles. Turnbull and McIntosh (*Brit. J. of Exper. Path.*, 1927, **7,** 181) described perivascular areas of myelin destruction as a result of nervous system invasion in variola and vaccinia. Ford and Wilson (*Bull. Johns Hopkins Hosp.*, 1927, **40,** 337) found similar lesions. Perdrau (*Brit. J. of Path. and Bacter.*, 1928, **31,** 17) confirmed these findings and stated that measles and other fevers probably cause similar lesions in the nervous system. These authors, however, all emphasized the presence of perivascular lymphocytic infiltrations which we have learned are usually absent, or at least inconspicuous, in nervous lesions due to measles.

SUMMARY AND CONCLUSIONS

1. Measles is followed by symptoms referable to the nervous system in about four-tenths of one per cent of all cases (Boenheim). The author has been able to find 113 cases described in the literature and contributes 12 additional cases from the Harriet Lane Home and the New Haven Hospital.

2. The onset is usually on the fourth to sixth day of the disease after the fever has fallen and the rash has begun to fade, but the onset may also occur at the height of the fever or in rare instances even during the prodromal period.

3. The nervous symptoms are initiated by drowsiness and convulsions followed by stupor, and accompanied by a sharp secondary rise in temperature. Muscular rigidity and twitching are typical

at this stage. From this stupor the child may recover promptly without residual symptoms or the stupor may be prolonged and a great variety of nervous symptoms may be revealed by returning consciousness. Spastic paralyses, ataxias, tremor, choreic or athetoid movements, myoclonus and aphasias are common. Cerebellar ataxias are described. Spinal cord syndromes constitute a large group. Mental disturbances during convalescence are present almost invariably and prolonged toxic-delirious psychoses have been reported.

4. The spinal fluid usually shows a moderate increase in lymphocytes, and in some cases the count may reach 200. A small percentage of polymorphonuclear leucocytes may be present. In rare cases, not demonstrably complicated, the fluid may be turbid with leucocytes. The protein is moderately increased. Sugar is normal or diminished (Lust). Film formation is rarely seen. The pressure is increased in most cases and may rise to 400 mm. Ambrus has described discoloration of the last few tubes in the gold chloride test.

5. The pathological-anatomical process is that of a toxic-degenerative rather than an inflammatory process according to recent studies by Siegmund, Creutzfeld, Guillery, Wohlwill and Sjövall. There is characteristically a perivascular myelin destruction with collection of lipoid waste products in phagocytes and even in the nervous tissues. There is also great congestion of the vessels with swelling and fatty changes in the vascular endothelium. Multiple small hemorrhages may occur (Musser). The glia cells contain fatty granules and there is some increase in the glial fibers. Very little change can be made out in the axis cylinders and little or no destruction of the nerve cells. The above picture is probably not specific for measles.

6. The prognosis for life is good. Only about 10 per cent of all patients die. About 65 per cent of those who survive show residual symptoms; weakness in thirty per cent, ataxia in twelve per cent, mental defect or personality change in seventeen per cent and epilepsy in five per cent.

I wish to thank Dr. Edwards A. Park and Dr. G. F. Powers for permitting me to utilize their material and Dr. Adolf Meyer for help and encouragement.

THE TREATMENT OF 100 CASES OF ASTHMA WITH EPHEDRINE[1]

LESLIE N. GAY, M.D. AND NATHAN B. HERMAN, M.D.

From the Department of Medicine, Johns Hopkins University

The investigations of the pharmacologic action of the alkaloid, ephedrine, have been reviewed in a number of reports since the publication of the original work by Chen; hence it would be superfluous to present again these data in this clinical report. As a result of Chen's work many physicians have used ephedrine in the treatment of asthma, and without exception the results have been encouraging. In August, 1925, Miller (1) reported temporary improvement in several cases of paroxysmal asthma. His report in 1926 (2) was even more encouraging, and in 1927, Leopold (3) with Miller presented most interesting results from the use of ephedrine in 59 cases of bronchial asthma. Ephedrine given by mouth effected complete temporary relief in 56 per cent of such cases. The best results were obtained in the allergic and reflex cases, (84 and 100 per cent respectively); the least satisfactory results were obtained in the infectious group (38 per cent).

Munns and Aldrich (4) used the alkaloid in 22 children with bronchial asthma. In twelve instances (54 per cent) relief was afforded from the acute paroxysms. Four of the patients (18 per cent) were only partially relieved, and in six (27 per cent) the drug had no beneficial effect. Pollak and Robitschek (5) used it in 16 cases of bronchial asthma and from their experience conclude that the attacks can be relieved within 15 minutes to half an hour. Jammerer and Dorrer (6) have treated 8 cases with favorable results.

The patients in the following report were treated with ephedrine by mouth after they had been examined in the Asthma Clinic of the Johns Hopkins Hospital. The majority of them have been under observation for more than one year. No attempt to select cases was

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made. Each patient was subjected to a complete diagnostic study. Clinically the cases could be grouped according to the following classification:

Group I. True bronchial asthma—due to hypersensitiveness—pollens, animal emanations, orris root, feathers, etc.

Group II. True bronchial asthma—due to hypersensitiveness—with secondary bronchitis (the so-called perennial asthma).

Group III. Asthmatic bronchitis—secondary to bacterial infection without any demonstrable hypersensitive state.

Group IV. Mixed cases—combination of Groups II and III with myocardial insufficiency.

With this classification it was possible to analyze conveniently our series of asthmatic patients (Tables I and II).

In Group I the patients promptly relieved exceeded in number those of the other three groups individually, and the percentage of failures was the smallest.

Group II, which parallels Group I closely in classification, except for the perennial character of the disease due to secondary bacterial infection, presents interesting results. Of these patients 79 per cent of the cases derived prompt relief and 14 per cent derived moderate relief, a total of 93 per cent, compared with 94 per cent in Group I.

It was with the bacterial Group III that the greatest difficulty was encountered. Prompt relief was obtained in 54 per cent of the cases (32 per cent less than in Group I and 25 per cent less than in Group II). However, attention is directed to the large percentage of patients (35 per cent) who obtained moderate relief in Group III. In other words, our failures in Group III were not so numerous as to cause discouragement. In the interesting Group IV, made up of a multiplicity of complications together with an entirely new factor, myocardial insufficiency, the results were excellent, 66 per cent receiving prompt relief.

Of considerable importance is the dosage of the drug which was required in the individual groups to give the various degrees of relief. It was found that the uncomplicated true bronchial asthmatic attacks required the smallest doses—25 to 50 mgm. in 30 minutes. The true bronchial asthmatic whose bronchi had been secondarily infected, and who as a result had developed perennial asthma, required from

TABLE I

Analysis of 100 patients who have used ephedrine

TYPE OF PATIENT	NUMBER OF CASES	AGE VARIATION	DURATION OF SYMPTOMS	DOSAGE OF EPHEDRINE	RESULTS OF TREATMENT	BY-EFFECTS	NUMBER OF CASES
Group I—true bronchial asthma due to hypersensitiveness (pollen, animal emanations, orris, etc.)	37	4 years to 54 years	From 1 year to 35 years	25 to 50 mgm. in 30 minutes	1. Relief prompt 32 2. Relief moderate 3 3. No relief 2 37	Tremor, insomnia, palpitation,	2
Group II—true bronchial asthma due to hypersensitiveness with secondary bronchitis (perennial asthma)	14	5 years to 63 years	From 2 years to 10 years	25 to 75 mgm. in 30 minutes	1. Relief prompt 11 2. Relief moderate 2 3. No relief 1 14	None	
Group III—asthmatic bronchitis (secondary to bacterial infection)	37	2 years to 55 years	From 18 months to 35 years	25 mgm. t.i.d.; b.d.; and 25 to 75 mgm. P.R.N.	1. Relief prompt 20 2. Relief moderate 13 3. No relief 4 37	Insomnia, tremor	4
Group IV—mixed cases (groups II and III) with myocardial insufficiency	12	42 years to 64 years	From 7 months to 25 years	50 to 100 mgm. P.R.N.	1. Relief prompt 8 2. Relief moderate 3 3. No relief 1 12	Insomnia, tremor, palpitation	3
Total.....	100						9

50 to 75 mgm. in 30 minutes. In Groups III and IV despite the fact that the dosage was considerably increased over that employed in Groups I and II, the results were not so favorable.

The unpleasant effects of ephedrine consisted chiefly of tremor, palpitation and insomnia. Of 100 patients, nine complained of some of these symptoms. None of the nine had serious reactions, although it was felt that the effects were so unpleasant that the drug was contraindicated.

During the time of observation of this series of patients adrenalin chloride (epinephrine) was used for the relief of symptoms in order that a comparison of the two drugs could be made. In every instance the relief obtained from adrenalin was prompt, but it likewise gave

TABLE II

Results of treatment—degree of relief

	PROMPT	MODERATE	NO RELIEF
	per cent	*per cent*	*per cent*
Group I—37 cases	86	8	6
Group II—14 cases	79	14	7
Group III—37 cases	54	35	11
Group IV—12 cases	66	25	9
Combined groups (100 cases)	71	21	8

rise to reactions that contraindicated its use in certain cases. The few individuals who were unable to take adrenalin were fortunately able to use ephedrine without the untoward symptoms. In other words, a reaction from adrenalin did not indicate that ephedrine likewise would have a similar unpleasant effect. The converse also was observed. In several instances it was found necessary to relieve acute paroxysms of asthma with a hypodermic injection of adrenalin, ephedrine given an hour before having failed to relieve the patient. Morphine was used in some cases as a last resort. There were no unpleasant symptoms observed from the combination of these drugs.

In *summary*, therefore, on the basis of a simple classification of 100 cases of asthma, it was found that ephedrine given by mouth produced most satisfactory results when administered to an asthmatic patient

at the onset of the paroxysm. Relief was most quickly obtained in the patients whose symptoms were due to a specific foreign protein. In the series of 100 cases eight failed to derive benefit from the drug. The authors are convinced that ephedrine is a drug which adds greatly to the relief of the individual suffering with asthma, but it by no means replaces adrenalin in the treatment of the acute paroxysms of the disease.

Note: The ephedrine sulphate used in this series of patients was contributed through the courtesy of Eli Lilly & Co.

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THE BACTERIAL CONTENT OF THE VAGINA AND UTERUS ON THE FIFTH DAY OF THE NORMAL PUERPERIUM[1]

JOHN W. HARRIS AND J. HOWARD BROWN

From the Departments of Obstetrics and of Pathology and Bacteriology, the Johns Hopkins Hospital and University

We have recently completed a clinical and bacteriological study of 113 cases of streptococcic puerperal infection, which will shortly appear in the *Bulletin of the Johns Hopkins Hospital*. Because of the fact that many of the patients in that series were not seriously ill notwithstanding the presence of streptococci in the uterus, it seemed advisable to study the uterine contents of a series of afebrile puerperal patients, using exactly the same technique in both series, in order to determine whether it is possible for streptococci to be present in the early puerperal uterus without giving rise to clinical manifestations of infection.

The question of the bacterial content of the normal puerperal uterus is still far from settled, although it is generally admitted that after the first week of the puerperium bacteria of various kinds, including the streptococcus, may usually be recovered from the uterine cavity. On the other hand, there is no unanimity of opinion as to the presence of bacteria in the uterine cavity before that time. Some investigators claim that during the first week the normal puerperal uterus is usually sterile, others that bacteria of various varieties can be recovered in the majority of cases, while a third group of investigators state that, although the uterus is rarely sterile, streptococci are not found.

For purposes of comparison with our series of streptococcic puerperal infections, we studied 30 patients—15 white and 15 black—all of whom had been delivered spontaneously at term and none of whom had at any time presented clinical evidences of infection. Since the majority of the uterine cultures in our series of infections were taken on the fifth day of the puerperium, they were likewise taken on the same day in the present series of normal patients.

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METHODS OF CULTURE

The external genitalia were thoroughly painted with a 2-per-cent alcohol-acetone solution of mercurochrome. A small sterile speculum was inserted into the vagina, care being taken to see that it did not come in contact with the labia. For purposes of control a culture from the vaginal fornix was then taken with a sterile cotton swab. After the cervix had been well exposed, it was wiped dry with sterile gauze sponges, and a sterile culture tube of the type described by Little (1) was introduced into the uterine cavity, carried up to the fundus and filled with lochia. Both the vaginal swab and uterine culture tube were immediately taken to the laboratory where smears and inoculations were made. The culture tube was broken in the middle and only the center of the column of lochia was used for bacteriological study. Although the use of the Little tube is not the ideal method for obtaining uterine secretions for bacteriological investigation, yet, after testing out various other methods, we are convinced that it possesses many advantages over those generally employed, and especially over the introduction of a cotton swab directly into the uterine cavity. It might be added that we attempted to use the device described by us (2) for taking vaginal cultures, but found that on the fifth day the lochia were so profuse that the proper unfolding of the rubber protecting dam was seriously interfered with. However, it seems to us that it can be employed most satisfactorily for obtaining uterine cultures late in the puerperium.

The secretions obtained from the vagina and uterus were inoculated into the following media: anaerobic and aerobic human blood agar plates, anaerobic and aerobic human serum bouillon and cooked meat medium sealed with vaseline. These media, and especially the last, we have found to be excellent for obtaining primary growths of all varieties of streptococci.

Table I shows that 10 of the 30 uteri cultured on the fifth day of the puerperium were absolutely sterile; while 20 were not, but in no instance was the streptococcus recovered. In the 20 positive cases, the bacteria cultivated consisted of several varieties of diphtheroids. It should be stated that five of the sterile uterine cultures were obtained from white and five from black patients.

TABLE I

CASE NUMBER	RACE	VAGINAL CULTURES	UTERINE CULTURES
N1	W	Aerobic non-hemolytic diphtheroid. *Staph. albus*	Aerobic non-hemolytic diphtheroid
N2	W	Anaerobic gamma streptococcus. Aerobic non-hemolytic diphtheroid. *Staph. albus*	Sterile
N7	W	Anaerobic gamma streptococcus. Anaerobic non-hemolytic diphtheroid	Anaerobic non-hemolytic diphtheroid
N8	W	Anaerobic gamma streptococcus. Anaerobic non-hemolytic diphtheroid	Anaerobic non-hemolytic diphtheroid
N16	W	Aerobic gamma streptococcus. Aerobic non-hemolytic diphtheroid. *Staph. albus*	Aerobic non-hemolytic diphtheroid
N17	W	Aerobic non-hemolytic diphtheroid	Sterile
N18	W	Anaerobic gamma streptococcus. Aerobic non-hemolytic diphtheroid	Aerobic non-hemolytic diphtheroid
N19	W	Anaerobic gamma streptococcus. Aerobic non-hemolytic diphtheroid	Sterile
N20	W	Anaerobic gamma streptococcus. Anaerobic non-hemolytic diphtheroid	Anaerobic non-hemolytic diphtheroid
N21	W	Anaerobic gamma streptococcus. Aerobic non-hemolytic diphtheroid	Sterile
N22	W	Aerobic non-hemolytic diphtheroid. *Staph. albus*	Aerobic non-hemolytic diphtheroid
N27	W	Aerobic alpha streptococcus. Aerobic non-hemolytic diphtheroid	Aerobic non-hemolytic diphtheroid
N28	W	Anaerobic gamma streptococcus. Anaerobic non-hemolytic diphtheroid. *B. coli communis*	Sterile
N29	W	Aerobic gamma streptococcus. Aerobic non-hemolytic diphtheroids (2 strains)	Aerobic non-hemolytic diphtheroid
N30	W	Aerobic gamma streptococcus. Anaerobic non-hemolytic diphtheroid. *Staph. aureus*	Anaerobic non-hemolytic diphtheroid
N3	B	Aerobic non-hemolytic diphtheroid. *Staph. albus*	Aerobic non-hemolytic diphtheroid
N4	B	Aerobic non-hemolytic diphtheroid. *Staph. albus*	Aerobic non-hemolytic diphtheroid
N5	B	Aerobic alpha streptococcus. Anaerobic non-hemolytic diphtheroid	Anaerobic non-hemolytic diphtheroid

TABLE I—*Concluded*

CASE NUMBER	RACE	VAGINAL CULTURES	UTERINE CULTURES
N6	B	Anaerobic gamma streptococcus. Anaerobic non-hemolytic diphtheroid	Anaerobic non-hemolytic diphtheroid
N9	B	Anaerobic gamma streptococcus. Aerobic non-hemolytic diphtheroid	Aerobic non-hemolytic diphtheroid
N10	B	Anaerobic gamma streptococcus. Aerobic non-hemolytic diphtheroid	Aerobic non-hemolytic diphtheroid
N11	B	Aerobic non-hemolytic diphtheroids (2 strains)	Sterile
N12	B	Aerobic alpha streptococcus. Aerobic non-hemolytic diphtheroid	Sterile
N13	B	Anaerobic gamma streptococcus. Aerobic beta-hemolytic diphtheroid. *Staph. albus*	Sterile
N14	B	Anaerobic gamma streptococcus. Anaerobic non-hemolytic diphtheroid. Aerobic non-hemolytic diphtheroid	Sterile
N15	B	Anaerobic gamma streptococcus. Aerobic non-hemolytic diphtheroid	Sterile
N23	B	Aerobic gamma streptococcus. Aerobic non-hemolytic diphtheroid	Aerobic non-hemolytic diphtheroid
N24	B	Anaerobic gamma streptococcus. Anaerobic non-hemolytic diphtheroid. Aerobic non-hemolytic diphtheroid. *Staph. albus*	Anaerobic non-hemolytic diphtheroid
N25	B	Anaerobic gamma streptococcus. Anaerobic non-hemolytic diphtheroid. Aerobic non-hemolytic diphtheroid. *Staph. albus*	Anaerobic non-hemolytic diphtheroid
N26	B	Anaerobic gamma streptococcus. Anaerobic non-hemolytic diphtheroid	Anaerobic non-hemolytic diphtheroid

Table I likewise shows that bacteria were present in the vaginae of all 30 patients studied and that from twenty-four of them streptococci were isolated, and in these cases again the two races were equally represented.

DISCUSSION

In a previous paper upon the bacterial content of the Caesarean section uterus (3) we showed that, whenever labor had lasted for six hours or longer, bacteria of various varieties, with the streptococcus predominating, could be recovered from the lower uterine segment. From that work we must assume that at the time of labor there is an upward extension of bacteria from the vagina to the uterus. While the exact mechanism of this upward extension of bacteria is not clearly understood, it seems probable that the capillary layers of fluid, which must extend from the uterine cavity to the vulva at the time of labor, would afford an excellent explanation for its accomplishment. Furthermore, a similar upward extension is clearly shown in the present series, for in each of the 20 patients whose uteri contained diphtheroids the identical variety of the organism was found in the vagina. On the other hand, diphtheroids, staphylococci, colon bacilli and, in 24 patients, streptococci were recovered from the vagina, but were not present in the uterus on the fifth day of the puerperium.

In view of our previous findings, it must be assumed that in all probability whatever organisms were present in the vagina at the time of labor must have ascended into the uterus at that time, but that they were rapidly killed off by the various defensive mechanisms of the body. At any rate, it seems probable from the present study that viable streptococci do not remain in the uterine cavity until the fifth day of the normal puerperium without giving rise to clinical manifestations of infection.

BACTERIOLOGY

Methods. The agar, broth and gelatin used were meat (usually pork) infusion media with a reaction of about pH 7.6. In making blood-agar plates about 0.75 cc. of defibrinated human blood was added to about 12 cc. of agar which had been melted and cooled to 45° to 50°C. "Pour" plates were always made and the type of appearance in blood-agar was always determined by the microscopic study of deep colonies after incubation for 48 hours and again after refrigeration for twenty-four or forty-eight hours. Anaerobic plates and broth were incubated in the jar described by one of us (4).

Fermentation reactions were determined in fermented broth prepared by the method of Smith (5). The carbohydrates were autoclaved in 10-per-cent aqueous solution and then there were added aseptically to each 5 cc. tube of fermented broth 0.5 cc. of carbohydrate solution and 5 drops of human serum previously heated to destroy the saccharolytic enzymes (TenBroeck, 6). After incubation of the cultures in the test media for one week hydrogen-ion concentrations were determined by the method of Brown (7).

All strains of streptococci were grown in plain and peptone milk, the results being the same in these two media. Gelatine cultures were incubated at 37°C. for one week and then refrigerated to determine whether liquefaction had taken place. Gas production in cooked meat was manifested by the raising of the vaseline seal. Mice were injected intraperitoneally with 0.5 cc. of twenty-four or forty-eight-hour broth cultures.

The cultural and biological characters of the streptococci and diphtheroids are shown in Tables II and III. These data require little comment at present but will be found useful for comparison with similar ones in other papers in this series.

Diphtheroids were the organisms most commonly found in these thirty normal cases. In the vagina aerobic diphtheroids predominated; in the uterus aerobic and anaerobic strains were found in about equal numbers. Only one hemolytic diphtheroid was found.

Streptococci were commonly found in the vagina but not in the uterus. The majority of the streptococci cultivated were anaerobic and of the gamma type in blood-agar. No beta-hemolytic streptococci were found. Only two strains of streptococci fermented mannite (*S. fecalis*).

Staphylococci were occasionally found in the vagina and in one instance the colon bacillus was found. Sporulating aerobes or anaerobes were not found in either the vagina or uterus. Döderlein's bacillus was not obtained in this series of cases but no special effort was made to cultivate it; anaerobic acid agar was not used. Bacilli resembling Döderlein's bacillus were often seen in vaginal smears.

TABLE II

Cultural and biological characters of the streptococci

CASE NUMBER	RELATION TO OXYGEN	TYPE IN BLOOD AGAR	FERMENTATION REACTIONS								MILK COAGULATION	COOKED MEAT (GAS)	GELATIN LIQ.	MOUSE PATH.	NOMENCLATURE (HOLMAN OR PREVOT)	DESIGNATION (BROWN, 10)	
			Glucose	Maltose	Sucrose	Lactose	Raffinose	Inulin	Mannite	Salicin							
N12 V	Aerobic	Alpha	4.8	5.1	4.8	5.3	6.9	6.9	6.9	5.6	+	−	+	−	*S. mitis*	Aerobic	1.1
N27 V	Aerobic	Alpha	5.3	5.3	5.3	5.3	6.9	6.9	6.9	5.5	+	−	−	−	*S. mitis*	Aerobic	1.1
N5 V	Aerobic	Alpha	5.1	5.7	7.0	7.0	7.0	7.0	6.9	7.0	−	−	−	−	*S. ignavus*	Aerobic	4.5
N29 V	Aerobic	Gamma	4.8	4.8	4.8	4.8	4.8	5.3	4.8	4.8	+	+	−	−	*S. fecalis*	Aerobic	5.4
N16 V	Aerobic	Gamma	4.8	4.8	4.8	4.8	5.1	7.3	5.0	4.8	+	−	+	−	*S. fecalis*	Aerobic	5.2
N30 V	Aerobic	Gamma	4.8	4.8	4.8	5.1	4.8	5.1	7.3	5.3	+	−	−	−	*S. mitis*	Aerobic	1.4
N23 V	Aerobic	Gamma	6.2	7.1	6.7	7.1	7.0	7.0	7.1	7.0	−	−	−	−			
N7 V	Anaerobic	Gamma	4.8	5.8	4.8	5.3	5.3	7.1	7.2	5.0	+	+	−	−		Anaerobic	1.2
N19 V	Anaerobic	Gamma	5.0	5.0	5.2	7.3	7.3	7.3	7.3	5.1	−	+	−	−	Group A1	Anaerobic	3.1
N26 V	Anaerobic	Gamma	5.0	5.4	5.0	5.3	7.4	7.4	7.4	7.4	+	+	−	−	Group A1	Anaerobic	2.1
N8 V	Anaerobic	Gamma	4.8	5.3	4.9	7.5	7.5	7.6	7.5	7.5	−	+	−	−	Group A1	Anaerobic	2.1
N9 V	Anaerobic	Gamma	4.8	5.3	5.3	7.1	7.2	7.3	7.3	7.3	−	+	−	−	Group A1	Anaerobic	2.1
N13 V	Anaerobic	Gamma	5.0	5.3	5.0	7.4	7.3	7.3	7.4	7.4	−	+	−	−	Group A1	Anaerobic	2.1
N14 V	Anaerobic	Gamma	5.2	5.2	5.2	7.4	6.9	7.1	7.2	7.1	−	+	−	−	Group A1	Anaerobic	2.1
N20 V	Anaerobic	Gamma	4.8	5.3	5.1	7.4	7.5	7.5	7.3	7.4	−	+	−	−	Group A1	Anaerobic	2.1
N21 V	Anaerobic	Gamma	5.8	5.8	5.9	7.4	7.5	7.3	7.1	7.0	−	−	−	−	*S. micros*	Anaerobic	2.1
N25 V	Anaerobic	Gamma	5.0	5.3	5.1	7.3	7.3	7.1	7.3	7.2	−	−	−	−	*S. micros*	Anaerobic	2.1
N2 V	Anaerobic	Gamma	5.3	5.4	7.5	7.5	7.5	7.6	7.3	5.3	−	+	−	−	Group A1	Anaerobic	4.5
N6 V	Anaerobic	Gamma	5.3	5.4	6.9	7.0	7.0	7.1	7.1	7.1	−	+	−	−	Group A1	Anaerobic	4.5
N10 V	Anaerobic	Gamma	5.6	5.7	7.0	7.1	7.1	7.1	7.1	7.1	−	+	−	−	Group A1	Anaerobic	4.5

N15 V	Anaerobic	Gamma	7.3	7.3	7.3	7.3	7.3	7.1	7.3	7.3	–	–	–	–	*S. micros*	Anaerobic	0.0
N18 V	Anaerobic	Gamma	7.2	7.3	7.3	7.3	7.3	7.4	7.3	7.4	–	–	–	–	*S. micros*	Anaerobic	0.0
N24 V	Anaerobic	Gamma	7.3	7.1	7.3	7.4	7.2	7.1	7.1	7.2	–	–	–	–	*S. micros*	Anaerobic	0.0
N28 V	Anaerobic	Gamma	7.3	7.4	7.4	7.4	7.4	7.4	7.4	7.4	–	–	–	–	*S. micros*	Anaerobic	0.0

Note: The figures under fermentation reactions indicate pH values. Those in heavy type are regarded as positive fermentations. Those italicized are doubtful.

Holman (8) employed only three carbohydrates (mannite, lactose and salicin) in his classification of the aerobic streptococci and did not recognize the gamma type as distinct from the alpha type in blood-agar.

Prevot (9) did not employ fermentation tests in his classification of the anaerobic streptococci. Our attempt to identify some of our strains with those described by him is based upon gas formation, coagulation of milk and liquefaction of gelatin. His Group A1 includes three species *S. foetidus*, *S. anaerobius* and *S. putridus*.

The term anaerobic is used to describe only obligate anaerobes; while the term aerobic is applied to all organisms which grow aerobically. Most, if not all, of the latter are facultative organisms.

TABLE III

Cultural and biological characteristics of diphtheroids

CASE NUMBER	REACTION TO OXYGEN	HEMOLYSIS	COLOR OF COLONY	FERMENTATION REACTIONS			GAS IN COOKED MEAT
				Dextrose	Maltose	Sucrose	
N1 V	Aerobic	Non-hemolytic	Green	5.0	5.1	5.0	+
N1 U	Aerobic	Non-hemolytic	Green	5.0	5.2	4.9	+
N2 V	Aerobic	Non-hemolytic	Green	5.1	5.0	5.1	+
N3 V	Aerobic	Non-hemolytic	Green	5.3	5.4	5.2	+
N3 U	Aerobic	Non-hemolytic	Green	5.1	5.3	5.4	+
N4 V	Aerobic	Non-hemolytic	Green	5.2	5.2	5.3	+
N4 U	Aerobic	Non-hemolytic	Green	5.4	5.3	5.4	+
N9 V	Aerobic	Non-hemolytic	Green	4.8	4.8	5.0	+
N9 U	Aerobic	Non-hemolytic	Green	4.8	4.8	4.8	+
N12 V	Aerobic	Non-hemolytic	Green	5.5	5.5	5.4	+
N19 V	Aerobic	Non-hemolytic	Green	5.1	5.3	5.4	+
N21 V	Aerobic	Non-hemolytic	Green	5.3	5.2	5.3	+
N22 V	Aerobic	Non-hemolytic	Green	4.8	7.4	4.8	+
N22 U	Aerobic	Non-hemolytic	Green	5.0	7.3	5.2	+
N10 V	Aerobic	Non-hemolytic	Green	7.1	7.3	7.3	+
N10 U	Aerobic	Non-hemolytic	Green	7.4	7.4	7.3	+
N11 V	Aerobic	Non-hemolytic	Green	7.4	7.3	7.5	+
N27 V	Aerobic	Non-hemolytic	Green	7.0	7.3	7.1	+
N27 U	Aerobic	Non-hemolytic	Green	7.2	7.1	7.3	+
N11 V	Aerobic	Non-hemolytic	White	5.1	5.8	5.2	−
N16 V	Aerobic	Non-hemolytic	White	4.8	4.8	4.8	−
N16 U	Aerobic	Non-hemolytic	White	4.8	4.8	4.8	−
N14 V	Aerobic	Non-hemolytic	White	5.2	5.4	5.2	+
N15 V	Aerobic	Non-hemolytic	White	5.3	5.6	5.4	+
N25 V	Aerobic	Non-hemolytic	White	5.3	7.5	5.3	+
N24 V	Aerobic	Non-hemolytic	Yellow	5.3	5.3	5.3	+
N17 V	Aerobic	Non-hemolytic	Yellow	5.2	7.3	5.1	+
N18 V	Aerobic	Non-hemolytic	Yellow	5.1	7.3	5.1	+
N18 U	Aerobic	Non-hemolytic	Yellow	5.1	7.4	5.1	+
N29 V	Aerobic	Non-hemolytic	Yellow	6.9	7.6	7.6	+
N23 V	Aerobic	Non-hemolytic	Clear	7.3	7.3	7.4	+
N23 U	Aerobic	Non-hemolytic	Clear	7.3	7.1	7.2	+
N29 V	Aerobic	Non-hemolytic	Clear	5.1	5.5	5.3	+
N29 U	Aerobic	Non-hemolytic	Clear	5.3	5.5	5.6	+
N13 V	Aerobic	Beta-hemolytic	Clear	7.3	7.5	7.3	−
N5 V	Anaerobic	Non-hemolytic	Green	4.8	4.8	4.8	+
N5 U	Anaerobic	Non-hemolytic	Green	5.1	5.3	5.2	+
N7 V	Anaerobic	Non-hemolytic	Green	4.8	5.5	5.0	+
N7 U	Anaerobic	Non-hemolytic	Green	4.9	5.5	5.0	+
N8 V	Anaerobic	Non-hemolytic	Green	6.7	7.1	7.0	+

TABLE III—*Concluded*

CASE NUMBER	REACTION TO OXYGEN	HEMOLYSIS	COLOR OF COLONY	FERMENTATION REACTIONS			GAS IN COOKED MEAT
				Dextrose	Maltose	Sucrose	
N8 U	Anaerobic	Non-hemolytic	Green	7.1	7.1	7.1	+
N14 V	Anaerobic	Non-hemolytic	Green	4.8	4.8	6.8	−
N20 V	Anaerobic	Non-hemolytic	Clear	5.1	5.1	5.1	+
N20 U	Anaerobic	Non-hemolytic	Clear	5.3	5.3	5.3	+
N30 V	Anaerobic	Non-hemolytic	Clear	6.0	6.0	6.1	+
N30 U	Anaerobic	Non-hemolytic	Clear	6.0	5.8	6.0	+
N6 V	Anaerobic	Non-hemolytic	Clear	7.2	7.2	7.2	+
N6 U	Anaerobic	Non-hemolytic	Clear	7.1	7.2	7.2	+
N24 V	Anaerobic	Non-hemolytic	Clear	7.3	7.3	7.3	+
N24 U	Anaerobic	Non-hemolytic	Clear	7.3	7.5	7.5	+
N25 V	Anaerobic	Non-hemolytic	Clear	7.1	7.0	7.3	+
N25 U	Anaerobic	Non-hemolytic	Clear	7.0	7.1	7.4	+
N26 V	Anaerobic	Non-hemolytic	Clear	7.3	7.3	7.3	+
N26 U	Anaerobic	Non-hemolytic	Clear	7.3	7.3	7.1	+
N28 V	Anaerobic	Non-hemolytic	Clear	7.3	7.4	7.0	+

SUMMARY

1. In thirty uteri cultured on the fifth day of the normal, afebrile puerperium only ten were found sterile, but none contained streptococci.

2. Vaginal cultures taken at the same time showed the presence of aerobic and anaerobic alpha and gamma streptococci in 24 of the 30 patients, but the aerobic, beta-hemolytic streptococcus, which is the etiological factor in the majority of fatal cases of puerperal infection, was not present in any of the patients studied.

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BOOK REVIEWS

Hysteria. By ERNST KRETSCHMER. Authorized English translation by Oswald H. Boltz. 120 pp. $2.50. (*Nervous and Mental Disease Publishing Co., New York, 1926.*)

The author does not attempt to present a clinical treatise on hysteria describing symptoms, diagnosis and treatment. He gives a theory of hysteria which, though original and ingenious, is not entirely new, inasmuch as it is based on the investigations of Kraepelin and Freud, viewed from a larger biological outlook. According to Kretschmer, the hysterical reaction is characterized by two outstanding facts, one of which is the tendency on the part of the hysterical individual to attain an end through his symptoms. This tendency may be operative in various degrees but it is always present even if only as a "dynamic part-component" which fixates, increases or perpetuates a psychological reaction. The other characteristic fact consists in the circumstance that the hysterical reaction makes use of mechanisms which are preformed in the individual organism, either as reflexes or generally in the instinctive life, as behavior-patterns. Kretschmer has made particular use of psychiatric experience with hysteria during the war. This has made his presentation perhaps a little one-sided as regards the hysterical manifestations to which his theories apply. The author's discussion is clear and fluent, but it leaves the impression that some of his formulations, though brilliant, are perhaps too simplified. The book can be highly recommended to any one interested in the psychopathology of hysteria.

F. I. W.

Malarial Psychoses and Neuroses. With chapters medico-legal, and on history, race degeneration, alcohol and surgery in relation to malaria. By WILLIAM K. ANDERSON, M.D., F.R.F.P.S. (Glas.). 395 pp. $13.00. (*Oxford University Press, London, 1927.*)

The author has observed 131 cases of mental disease associated with malaria. All his cases were in soldiers on service during the war. A large proportion of them came from Salonica "where malignant tertian malaria was very severe, and was for the most part inadequately treated." The majority of these patients showed depression and confusion; thirty-four had suicidal tendencies. The case histories presented are very brief and psychiatrically hardly adequate. The author's contribution is marred by the fact that his nosology is obsolete. He has assimilated neither Kraepelin nor Janet, not to speak of the more modern biological orientation. The inadequacy of the author's diagnostic scheme is particularly disturbing, since he gives remarkably little of what his patients actually said and did. The book contains, nevertheless, not a few interesting details, mainly culled from

the literature on the subject, which do not lend themselves easily to a brief summary. The author discusses the history of malaria, its medical and neurological aspects, and also has a chapter on surgery and malaria. The section on "General Paralysis (malarial)" is introduced by the equivocal sentence: "Dementia paralytica is generally associated aetiologically with syphilis." The malaria treatment of general paresis is not mentioned. In the chapter on medico-legal aspects a case of melancholia with suicide is included. He states that, of the 131 patients, 58 were guilty of punishable offences. However, in 34 of these cases the punishable offence consisted of suicidal tendencies.

The clinical psychiatric problem of malarial psychoses is bound up with the so-called exogenic (or dysergastic) reaction type. This chapter of psychiatry is badly in need of revision on the basis of concrete cases well-studied both medically and psychiatrically. There is no short-cut to this task. The author has not undertaken a full discussion of this central problem. The book is well printed and the illustrations are good. A long bibliography is appended. There is no concise statement of the author's conclusions.

F. I. W.

Psychotherapy: Mental Elements in the Treatment of Disease. By EDWARD WYLLYS TAYLOR. 52 pp. $1.00. (*Harvard University Press, Cambridge, 1926.*)

This little book on psychotherapy, being the substance of a lecture given at the Harvard club in Boston, is another volume in the excellent series of Harvard Health Talks. The series aims "to provide in easily accessible form modern authoritative information on medical subjects of general importance." In fine lucid style the author gives a survey of the historical development of psychotherapy, going back to the ancient "medicine man" whom Frazer considers the representative of the oldest professional class. To those who are ignorant of the subject the book is an excellent introduction; but, alas, at the present time such people seem to be rare. For that part of the public who have read all about the familiar chain of Charcot-Janet-Freud and who approach not only the physician but, what is more important and fraught with danger, themselves, in terms of psychoanalytic jargon, the author might have added a little more about the actual facts of minor mental maladjustments, and their modifiability by common-sense methods. The understanding of psychotherapy is bound up with the whole problem of psychogenesis in its many forms and in this domain clinical psychiatrists have done a great deal of spadework, with cases less startling and sensational than those usually quoted in the literature on psychotherapy, but certainly much more frequent.

F. I. W

Mongolism: A Study of the Physical and Mental Characteristics of Mongolian Imbeciles. BY KATE BROUSSEAU. Revised by H. G. Brainerd, M.D. 210 pp. $4.50. (*The Williams and Wilkins, Company, Baltimore, 1928.*)

The authors report upon their personal experience with Mongolian imbeciles

and other types of defectives during a period of more then ten years. They also obtained information from a questionnaire submitted to workers and physicians who had contact with Mongolism. They discard all the etiological theories so far advanced but believe that the condition is "possibly induced by some obscure disturbance of the ductless glands," since in every case some endocrine disturbance can be demonstrated. The morphological disorders associated with the condition are multiform. Apparently very little work has been done on the morphological study of Mongoloids with precise anthropometric methods. The authors have made a very painstaking study of the literature on the subject. In the psychopathological discussion the usual great stress is laid on mental tests. As to mental traits common to all Mongols, the authors state that they are, with few exceptions, placid, affectionate and good-humored. The association of Mongoloid imbecility with other psychopathological syndromes is not sufficiently discussed. The book has a very good bibliography and index; it is well printed and illustrated. It undoubtedly deserves the highest recommendation as an introduction to the study of this most interesting subject of constitutional pathology.

F. I. W.

Strabismus. Its Etiology and Treatment. By OSCAR WILKINSON, A.M., M.D., D.Sc. Pp. 240 with 120 illustrations. $10.00. (*C. V. Mosby Co., St. Louis, 1927.*)

The book is divided into twelve chapters. The first deals with the historical study of strabismus and is of considerable interest. The second discusses the etiology. The author divides the theories of strabismus into four groups: (1) the muscular, (2) the accommodation, (3) the fusion, and (4) the nervous theory. The last group he subdivides into cases showing pathologic nervous lesions and those with functional nervous manifestations. Under the head of pathologic nervous lesions he says, "Frank paralytic squint will be discussed under a separate chapter, and the remarks following will not deal with paralysis, but with the results of paralysis, or disease." This statement would appear to be somewhat ambiguous.

The author next considers the anatomy and physiology of the extra-ocular muscles and shows many well selected illustrations but no original ones. Clearness of description seems to suffer from the quoting of too many authors. In the chapter dealing with measurement of strabismus the author gives the well recognized methods of determining the amount of deviation, and adds one of his own, known as the 'Wilkinson Modification of the Holzer-Priestly Smith Tape,' which he prefers to the other methods. For treatment he divides his cases into two groups—non-operative and operative. The former, he claims, should not be continued for more than six months unless very definite improvement results. The usual methods of training are suggested. He advocates shortening operations combined with the use of a brace rather than tenotomies, and in the cases of children that require an anaesthetic, he uses a special rule for measuring the

amount of muscle to be resected. A table is given stating the amount of muscle that must be resected to correct a given deviation; for example, six millimeters' resection with a brace will correct 9° of deviation, while twelve millimeters will suffice for 20° of deviation.

Owing to the numerous quotations, contained in it, the volume should prove a useful addition to any library as a work for reference.

C. A. C.